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NEAR FIELD SOUND PRESSURE MEASUREMENTS OF A VIBRATED SONAR TRAN--ETC(U)
JUL 66 G M COLEMAN

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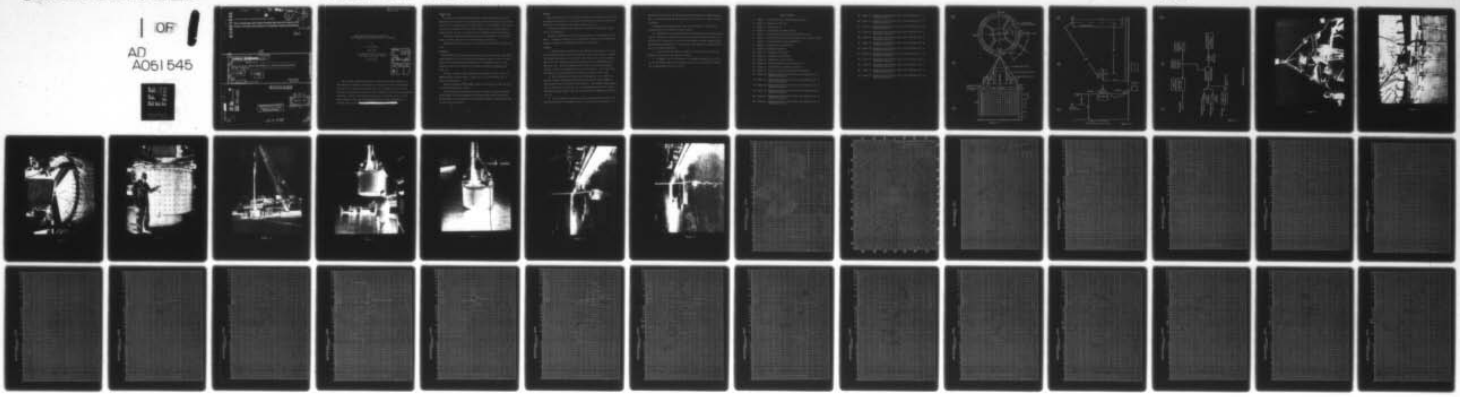

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NEL/Technical Memorandum 1064

TECHNICAL MEMORANDUM

NEL TM-1064

NEAR FIELD SOUND PRESSURE MEASUREMENTS OF A VIBRATED SONAR TRANSDUCER TR-208 - AN/SQS-23.

11 July 1966

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G. M. Coleman (NEL Code 3130C)

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NEL Technical Memorandum
Number 1064

NEAR FIELD SOUND PRESSURE MEASUREMENTS OF A VIBRATED SONAR TRANSDUCER TR-208 - AN/SQS-23

by

G. M. Coleman

Code 3130

U. S. Navy Electronics Laboratory
San Diego, California 92152

11 July 1966

This technical memorandum represents a portion of the work being done on NEL Problem J714, AN/SQS-23 Performance and Integration Retrofit Program (PAIR). It should not be construed as a formal report as its primary intent is to present some of the problems confronting project personnel and some of the preliminary conclusions. While it was originally published in a different form, it is now being included in the technical memorandum series for sake of documentation uniformity and control.

INTRODUCTION

As a part of the AN/SQS-23 Modernization Program, NEL Problem J714, and particularly that portion of the program directed to the description of possible sonar self noise problem areas the work reported in this memorandum is an effort to point out one aspect of the Self Noise Picture; that is, locally produced noise pressures caused by the vibration of the AN/SQS-23 transducer assembly.

Testing was conducted by personnel of the Electrodynamics Division, Code 3130, 9-11 March 1966, at the U. S. Naval Station, San Diego.

Handling of the array during the test period was by the Naval Station Crane Crew.

PROCEDURE

The method of testing consisted of measuring local water borne (near field) sound pressures at ten (10) discrete probe hydrophone positions about the periphery of the Sonar Transducer TR-208/SQS-23, (the transducer) while it was vibrated in each of two directions by vibration generators (shakers), (see Figure 1).

As shown in Figure 2, the transducer was suspended in water so that the shaker assembly was above water. Suspension of the entire assembly was by means of a truck crane.

Figures 4 through 12 describe the sequence of assembly and final positioning of the transducer for testing.

For convenience and rapid data acquisition outputs of the pre-calibrated accelerometers and Probe Hydrophones were analyzed and recorded sequentially as the shakers were vibrated with a sweep control frequency ranging from 50 cps to 5,000 cps. (see Figure 3).

RESULTS

For the two directions of vibration measurements were made of the near field sound pressure levels at the ten (10) probe hydrophone positions as well as the transducer's acceleration at two mounting flange positions.

The resulting data have been reduced to normalized sound pressure levels for one G acceleration.

Figures 14 through 22 are for vertical excitation of the transducer by the shaker. Figures 23 through 31 are for horizontal excitation of the transducer. Figures 13 through 15 are graphical summaries of the results.

COMMENTS

1. For the vertical excitation of the transducer there appears to be two general frequency bands of distinct character, the first up to about 1 KC where the average sound pressure level decrease with frequency at a rate of approximately 12 db per decade and having an average excursion of approximately plus and minus 8 db. The second frequency band is above 1 KC having an apparent increase in level with frequency of about 8 db per decade. In the second band the excursion of level decreases with frequency to about 10 db at 5 KC.

2. For the horizontal excitation case there appears to be a number of specific frequency bands where the average sound pressure levels suggests a multi-resonance and anti-resonance characteristic. The maximum average response level is about 80 db at about 375 cps, with an approximate excursion of 20 db. The minimum average response level is about 46 db with an approximate excursion of 7 db.

3. For the horizontal excitation case the mean sound pressure levels are fairly uniform about the periphery except in the direction of excitation. In

the bearing of 000 levels are significantly down throughout the sample frequency bands. In the bearing of 180 the mean levels are up for three of the five bands considered.

The polar plots slightly suggest that as the frequency of vibration is increased there is an increase in lobe structure.

4. Considering the vertical plan profile of generated sound pressure levels, when the transducer is vibrated horizontally the mean levels are minimum in the mid section of the transducer, for all consider frequency bands, suggesting that rocking modes are generated. At the upper and lower regions the levels are down only in the higher frequencies.

5. In the case of the vertical excitation the sound pressure fields were generally uniform about the transducer surface.

6. It appears that if the transducer is randomly accelerated at a level of one "G" the average near field sound pressure level six inches from the surface will be approximately 60 db re one μbar.

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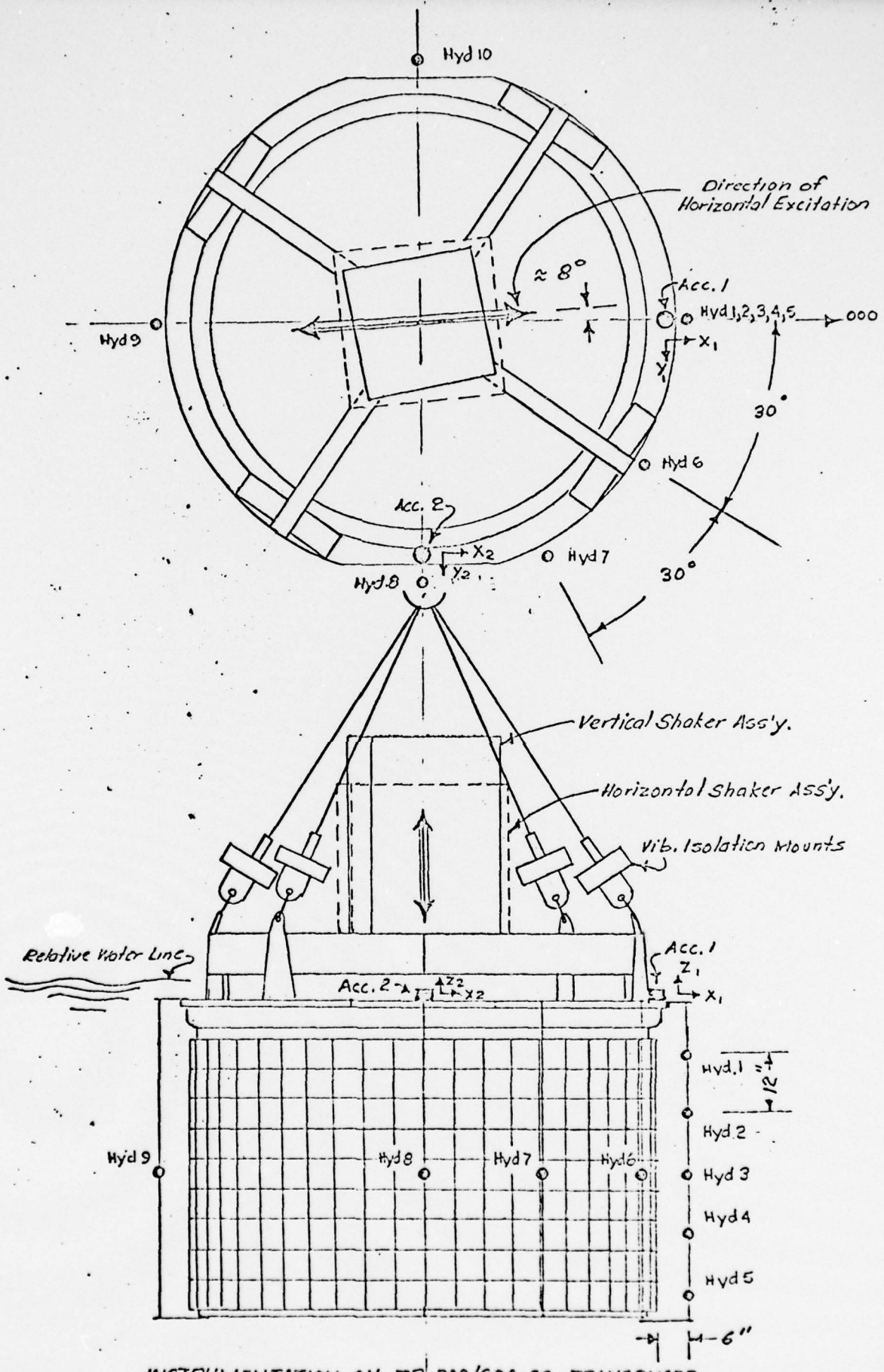
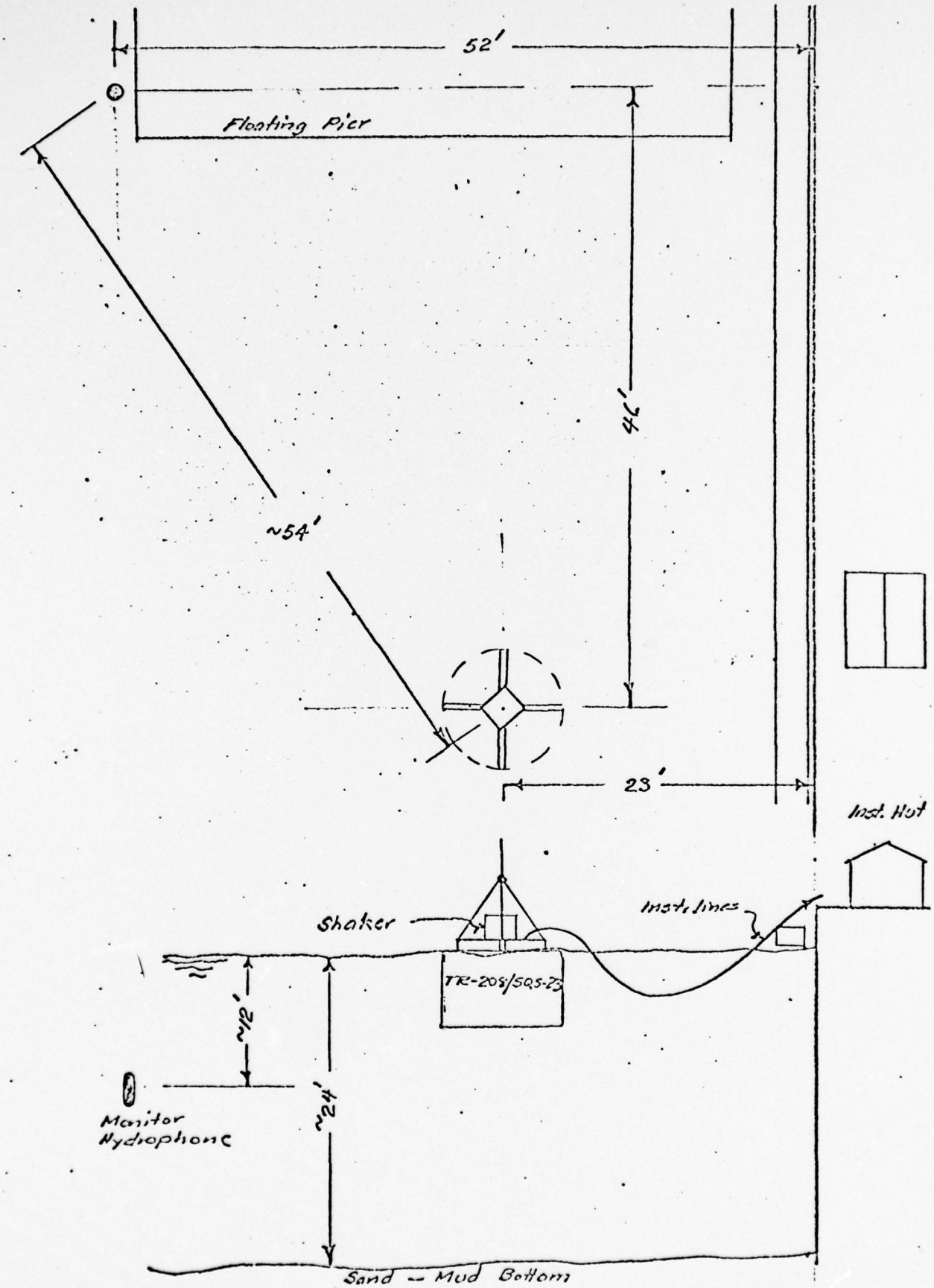


INSTRUMENTATION ON TR-208/SQS-23 TRANSDUCER

Figure 1



GEOMETRY OF TEST SITE

Figure 2

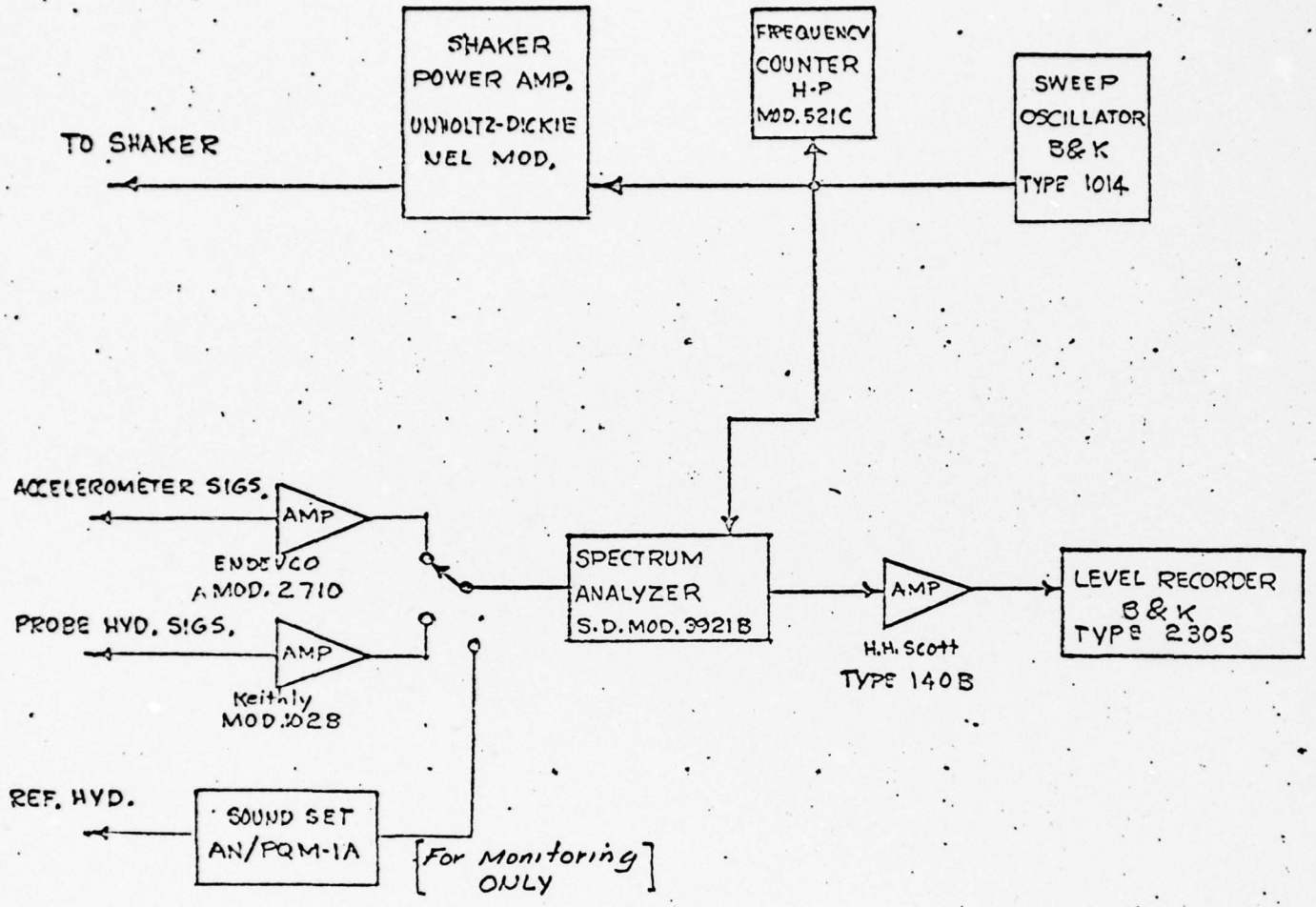
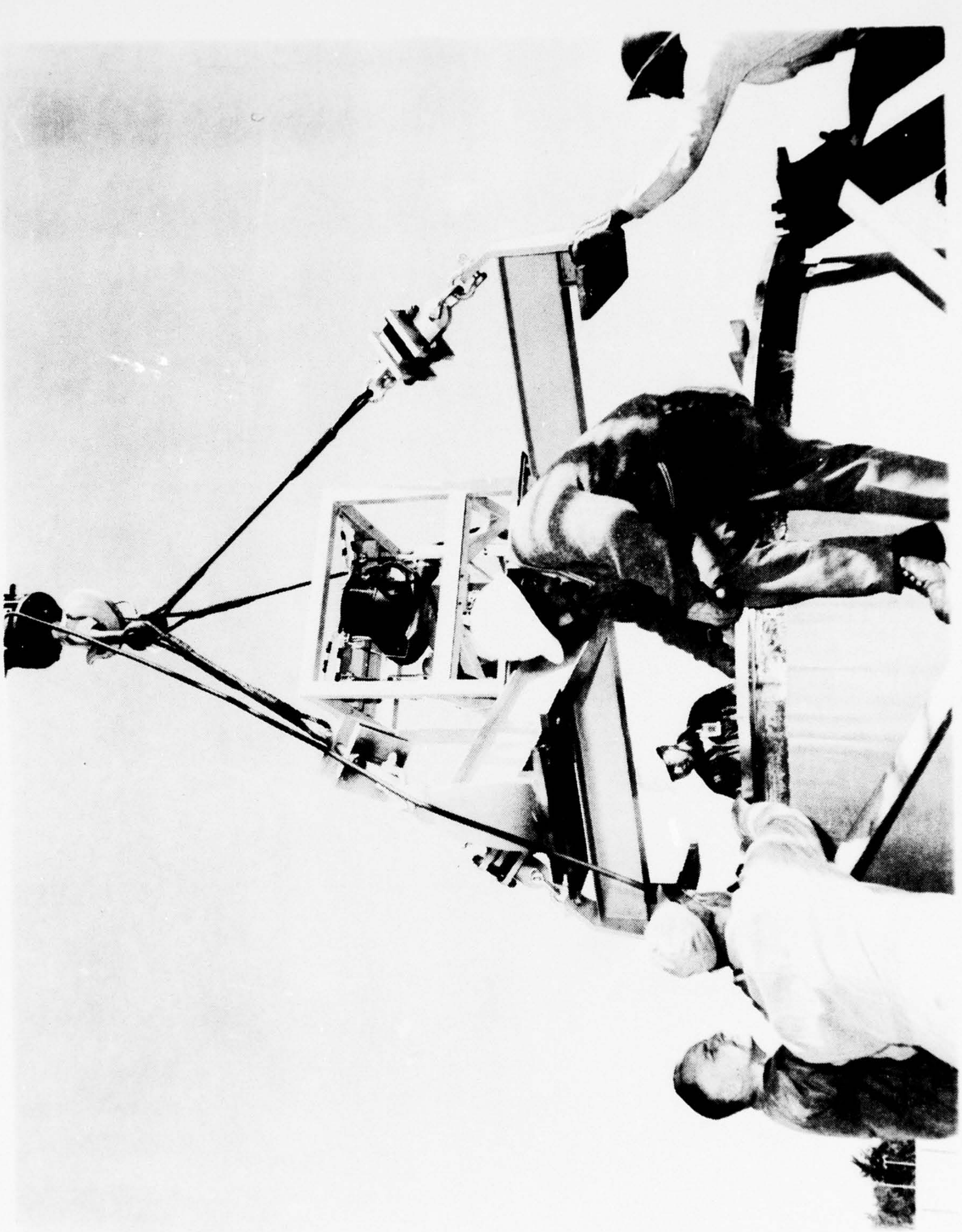


Figure 3

INSTRUMENTATION



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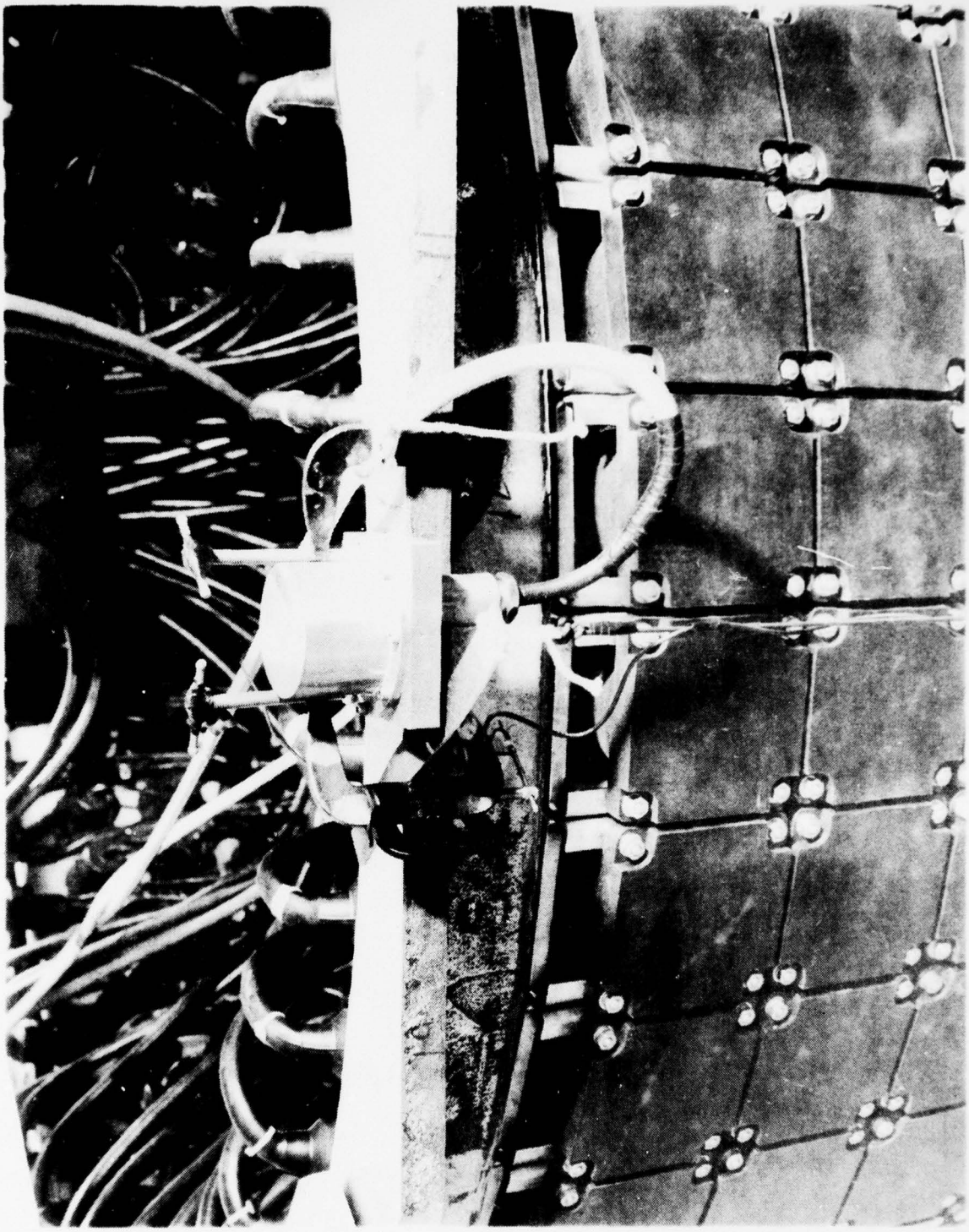

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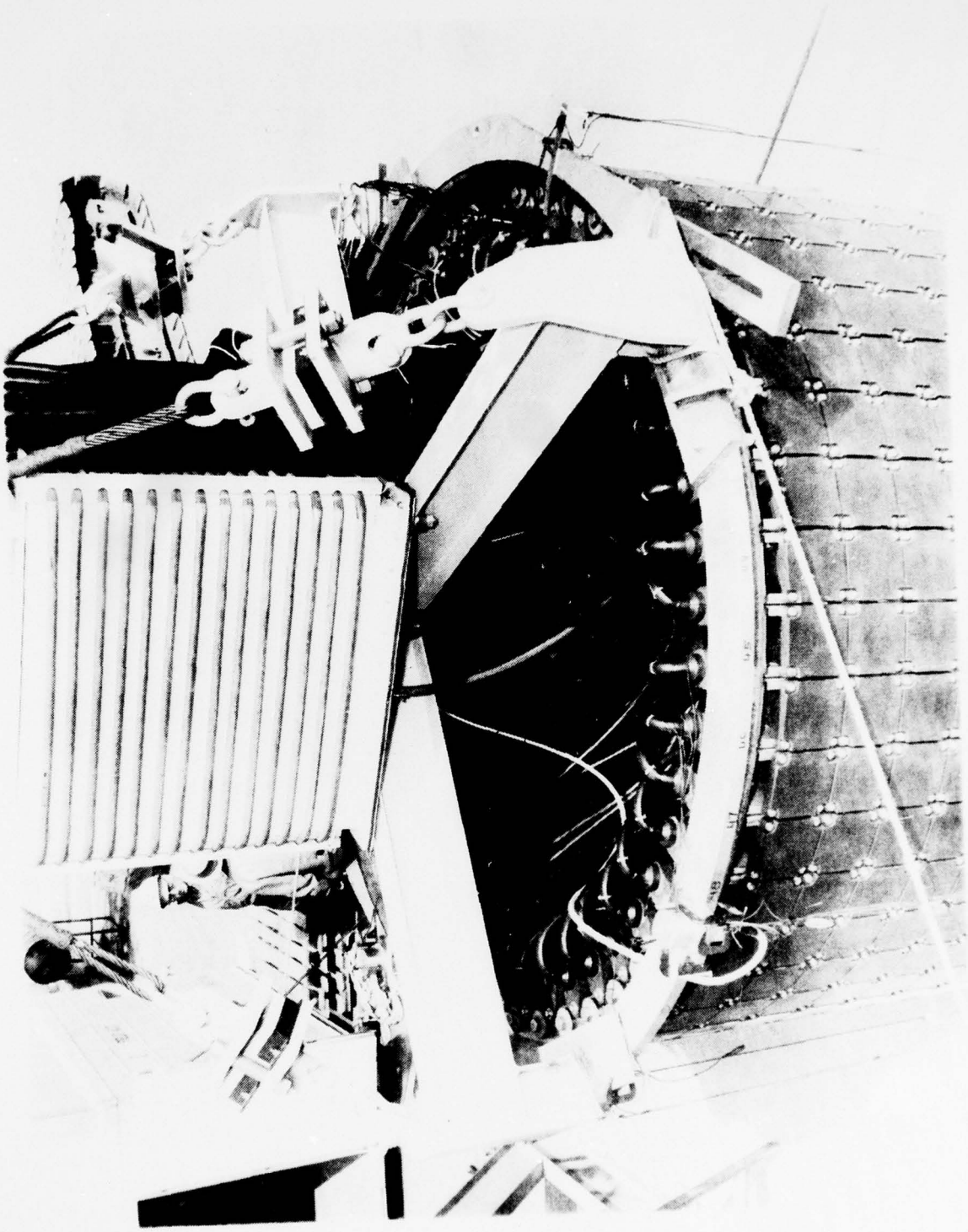

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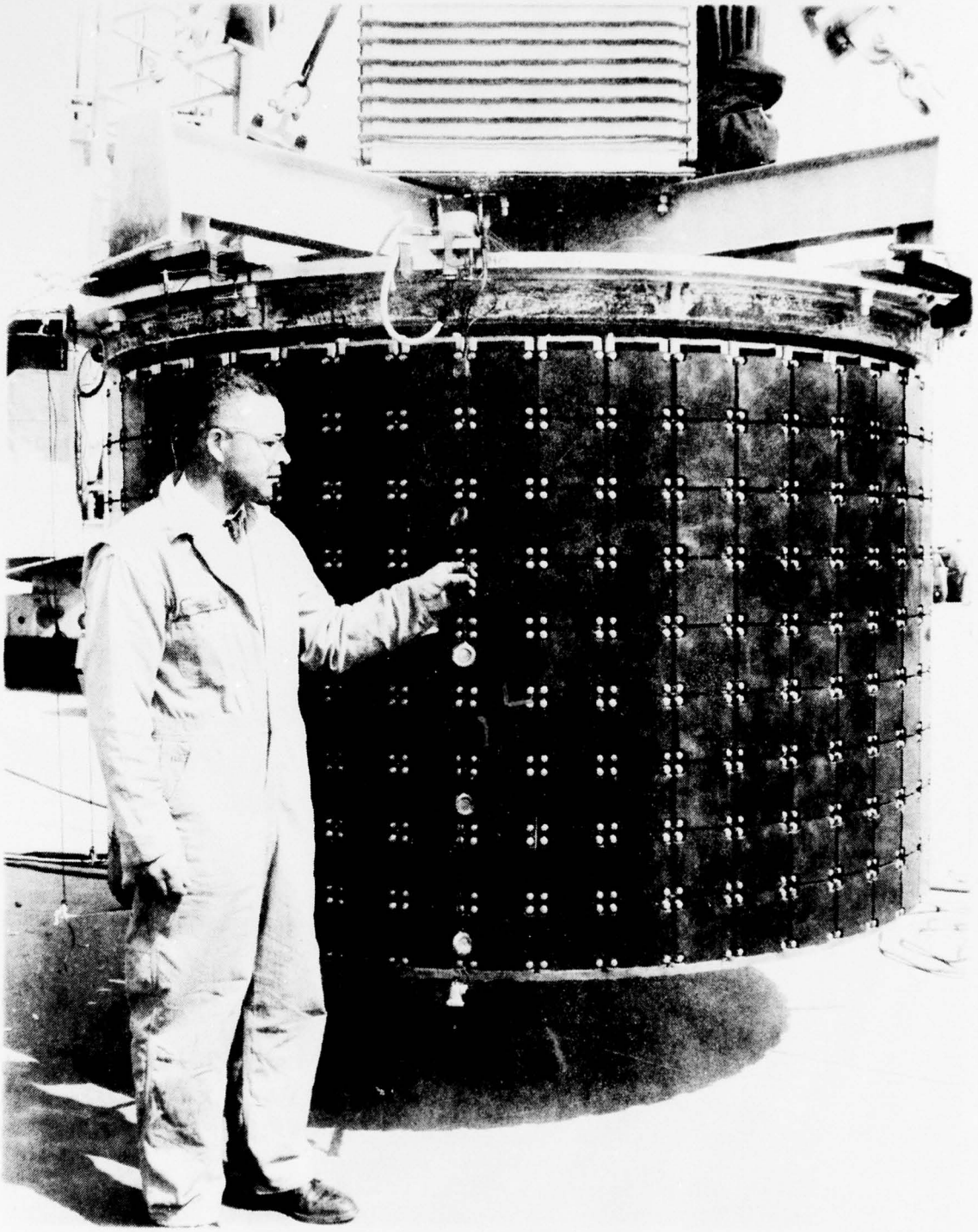

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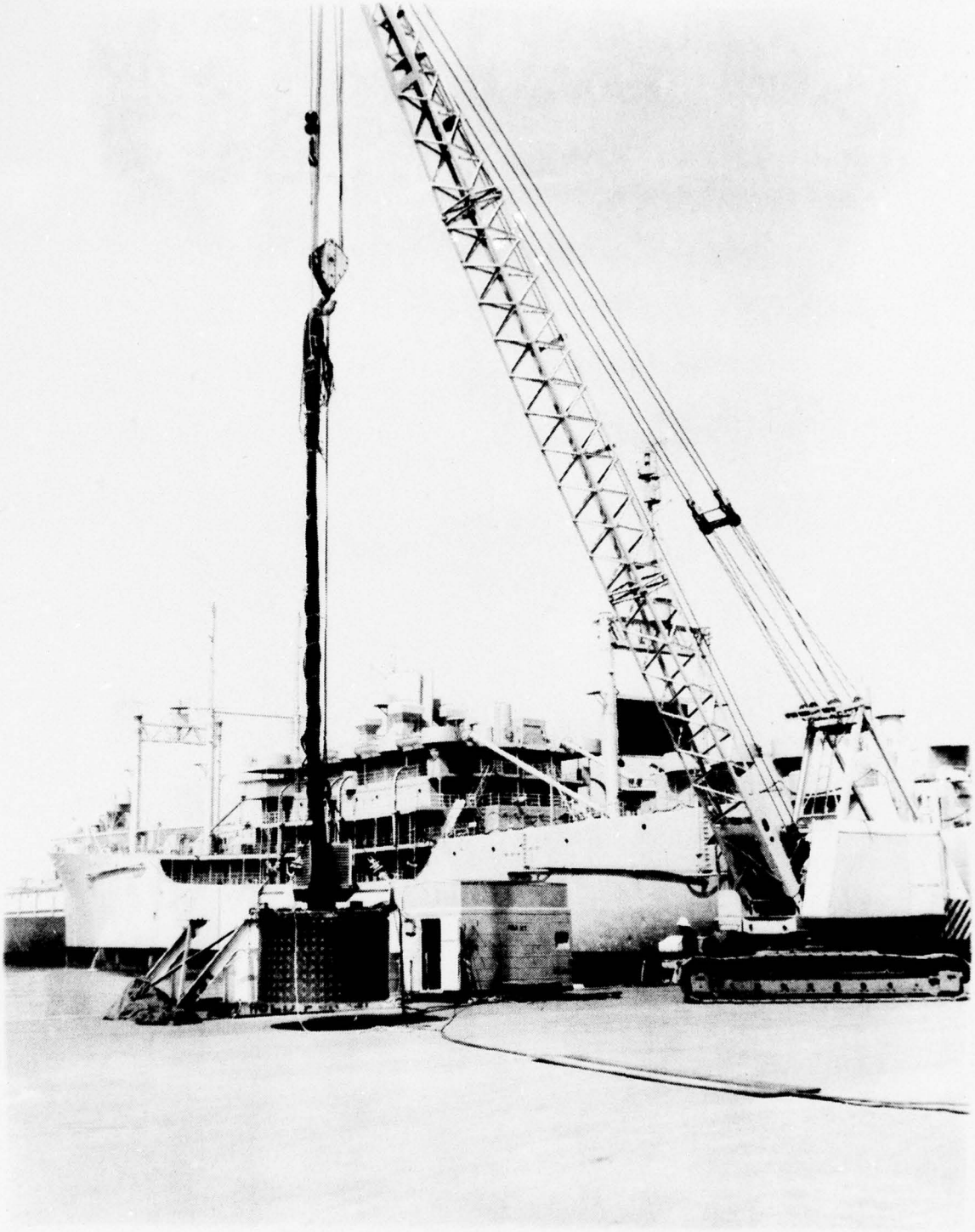


Figure 8

Figure 9

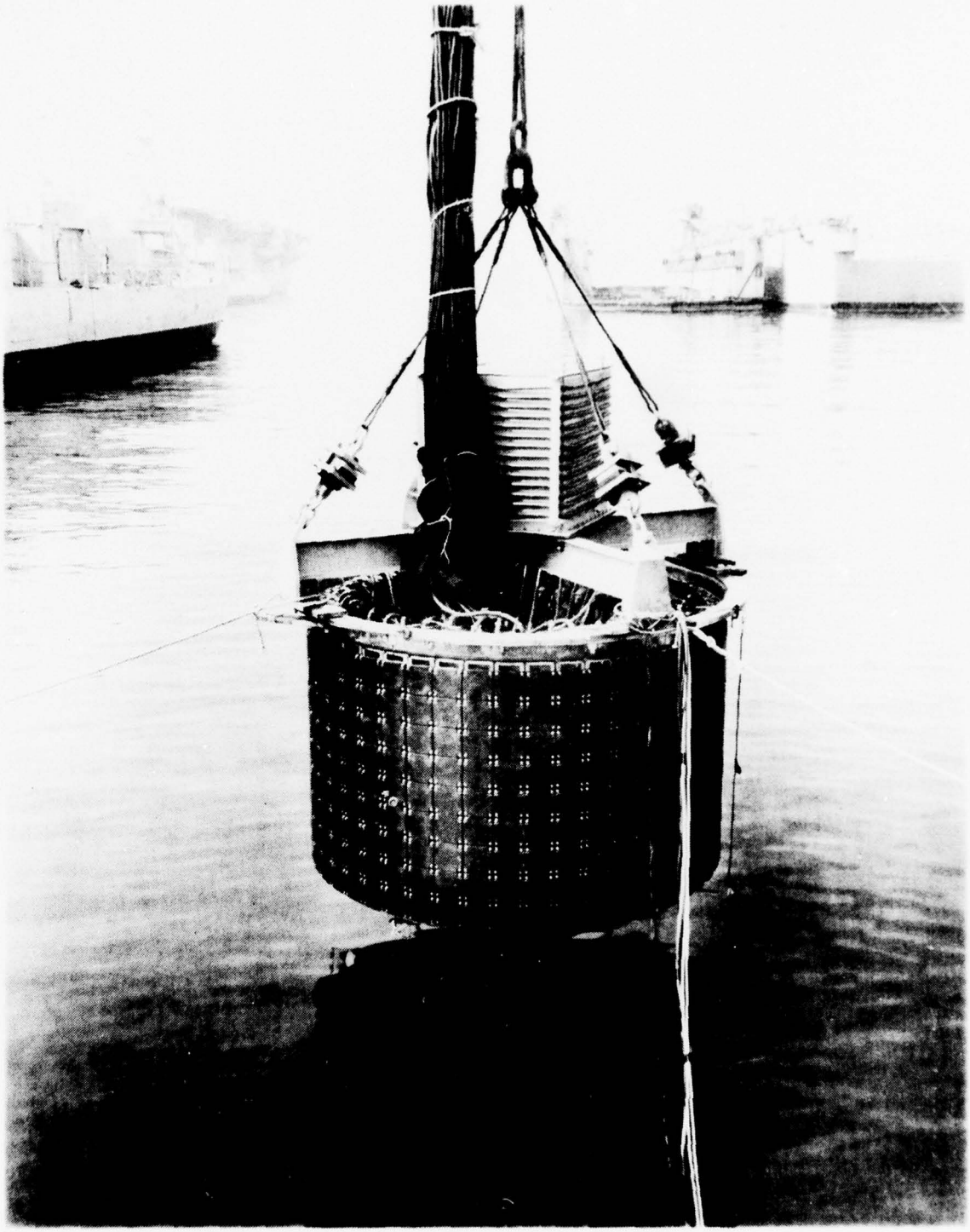
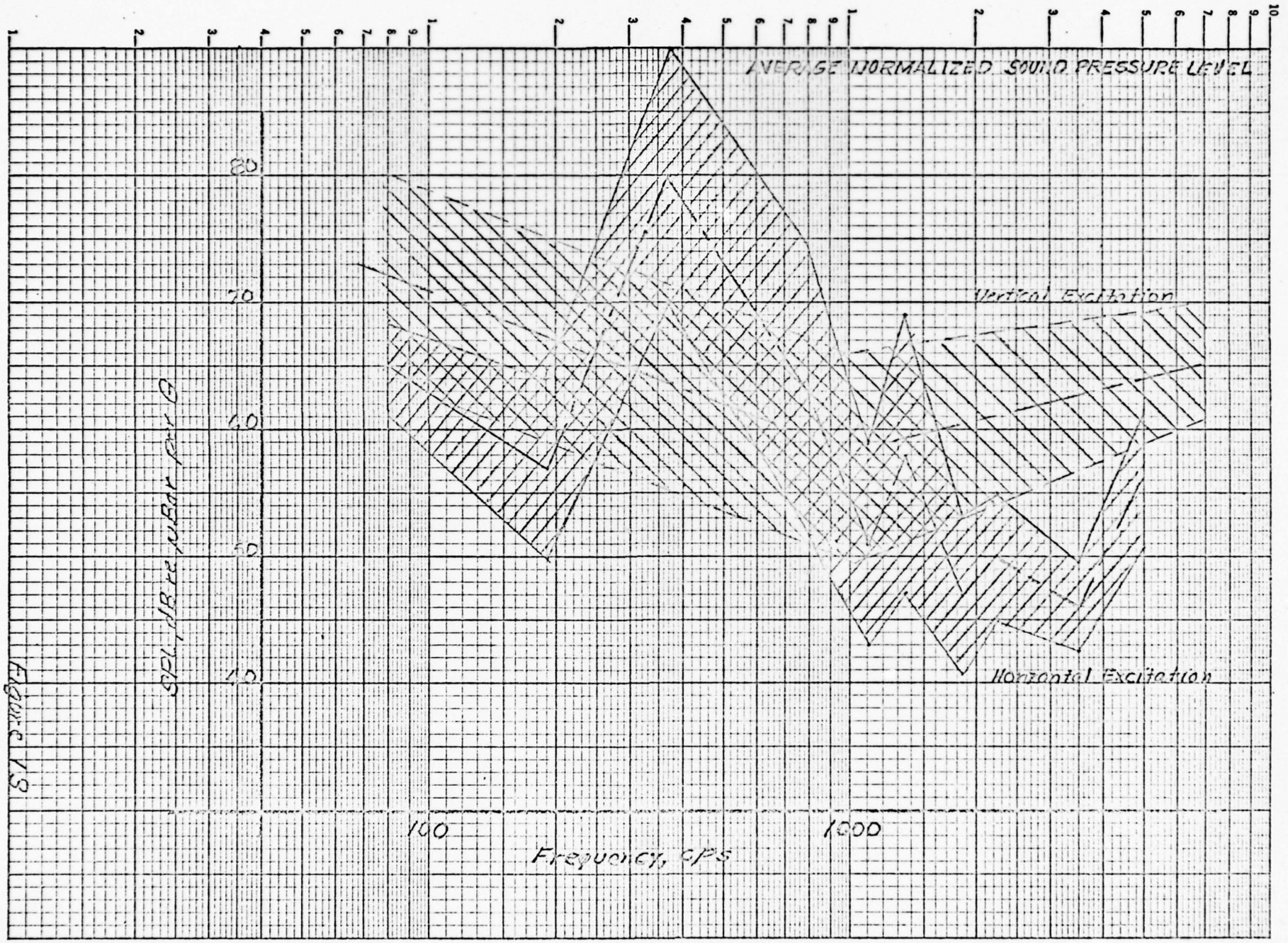


Figure 10

Figure 11

Figure 12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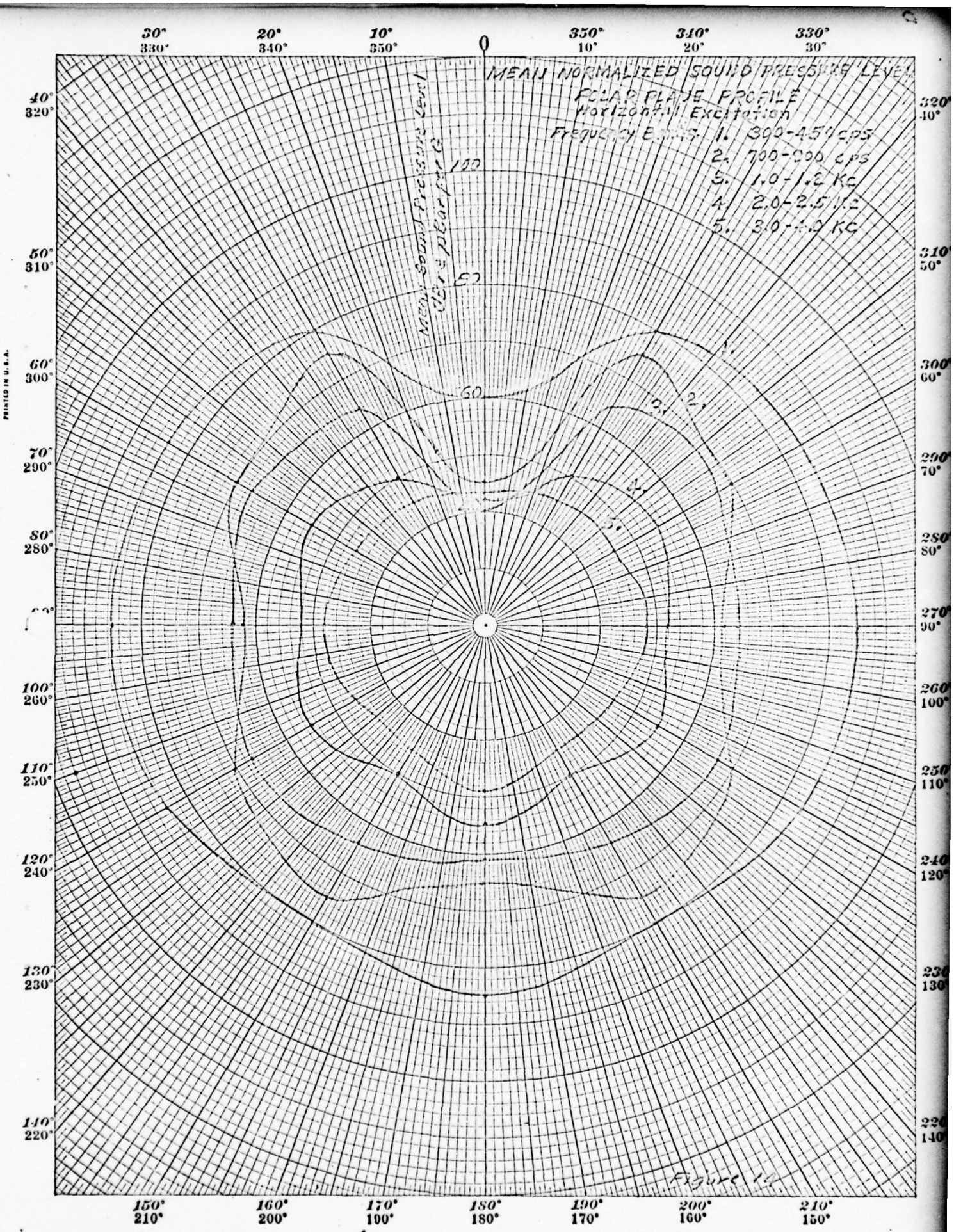
AVERAGE NORMALIZED SOUND PRESSURE LEVEL
Vertical Excitation
Horizontal Excitation
80
70
60
50
40
SOUND PRESSURE LEVEL, dB re 0.0002 μbar
100
1000
Frequency, cps



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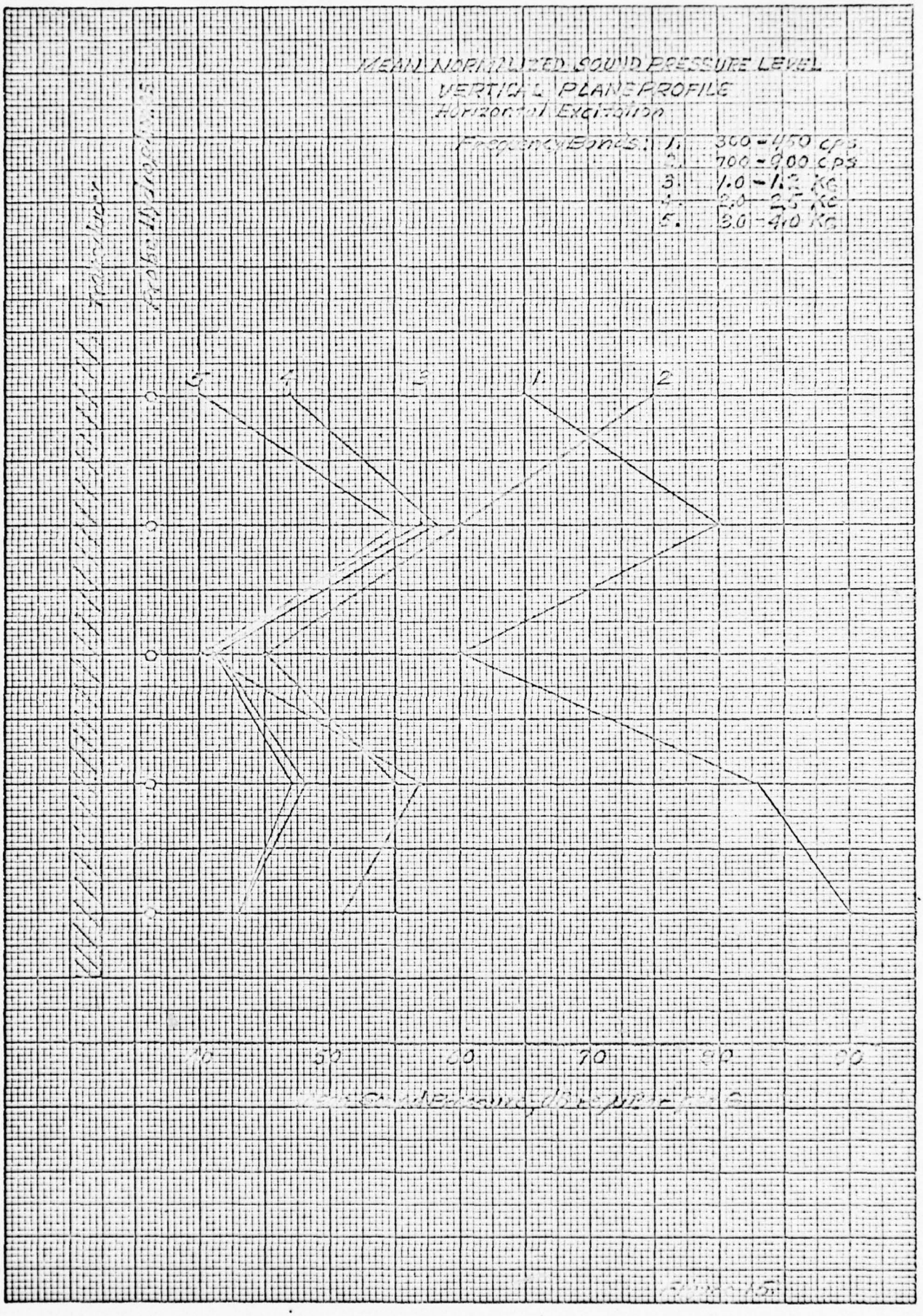

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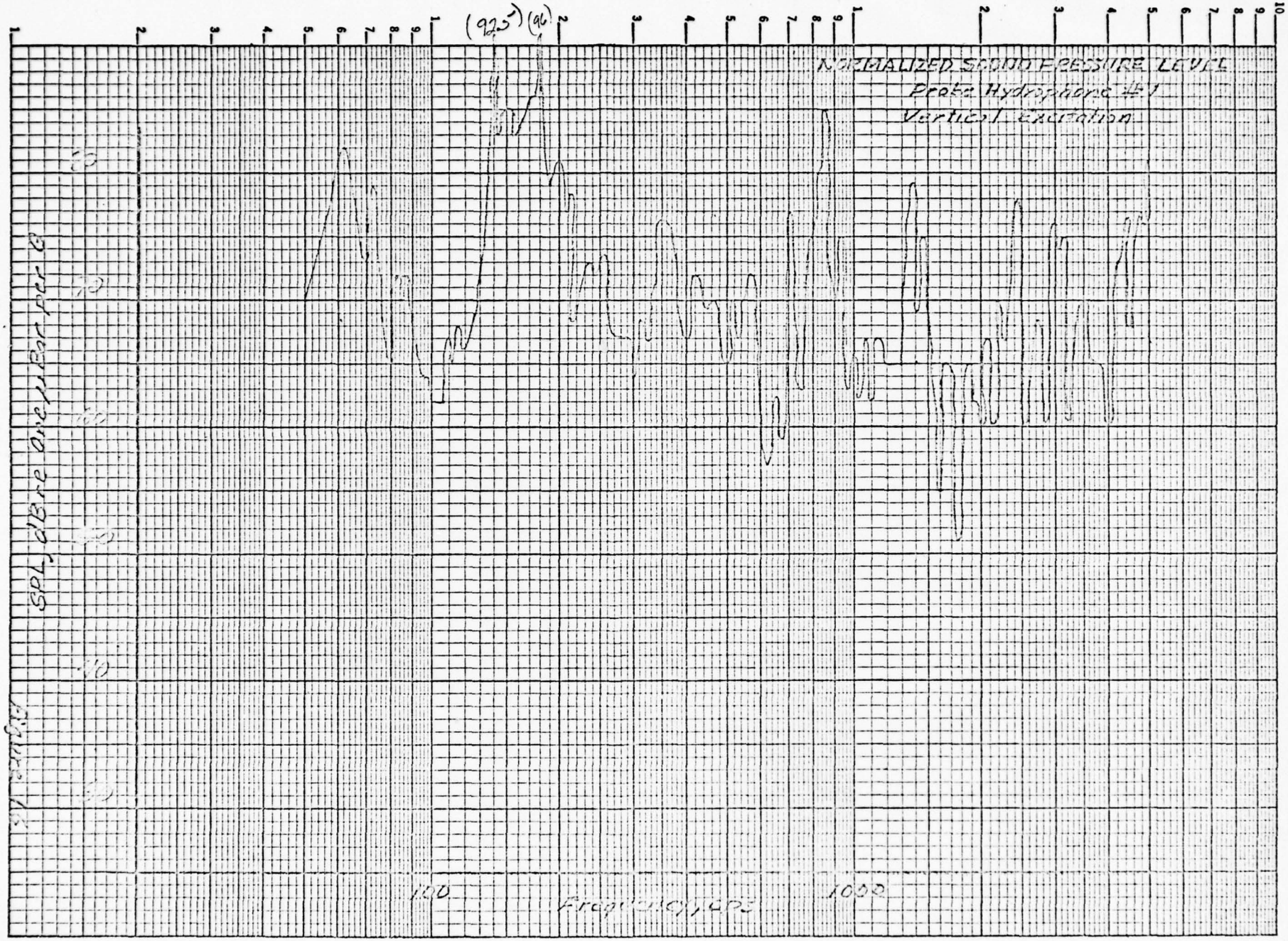

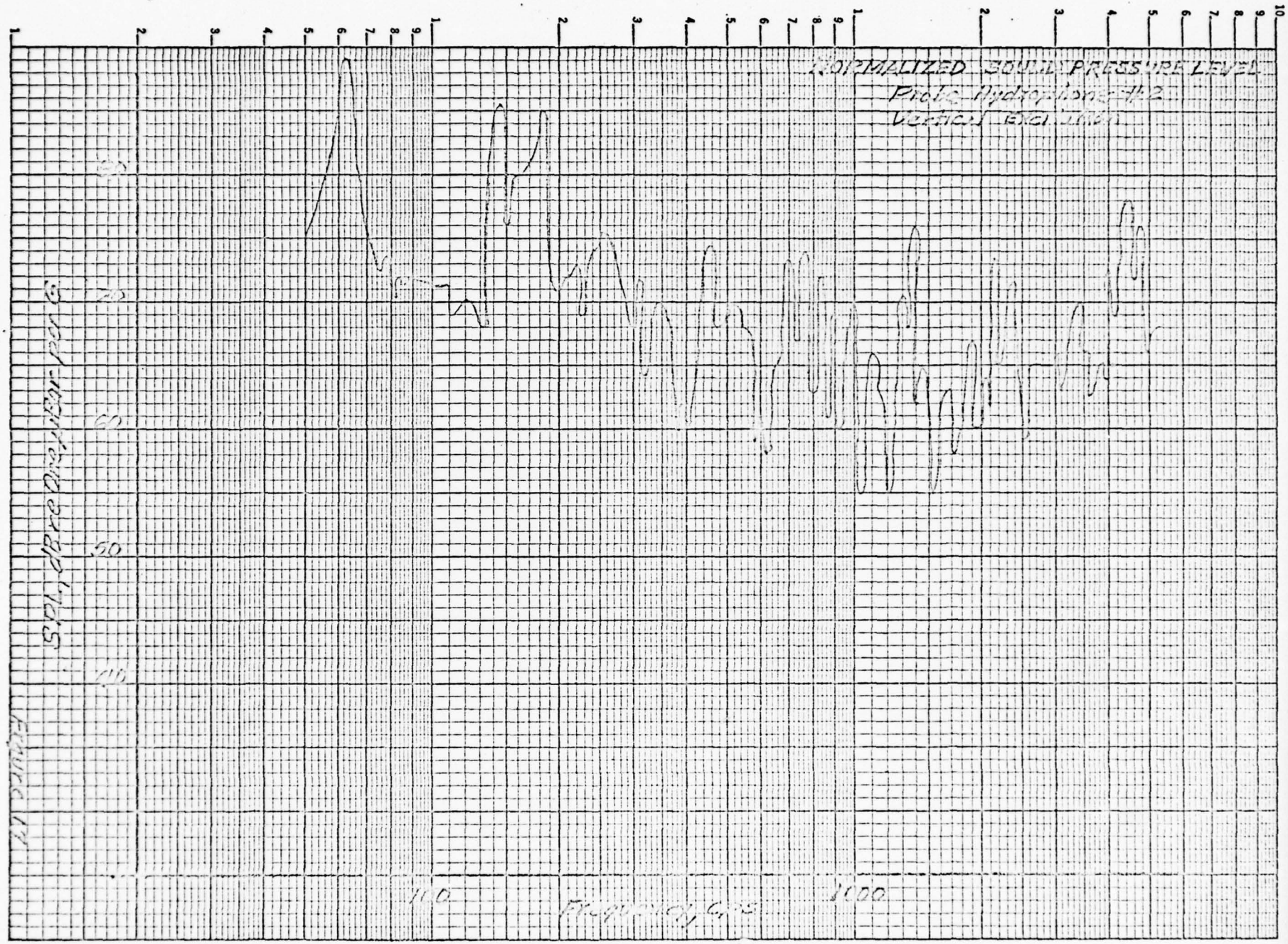
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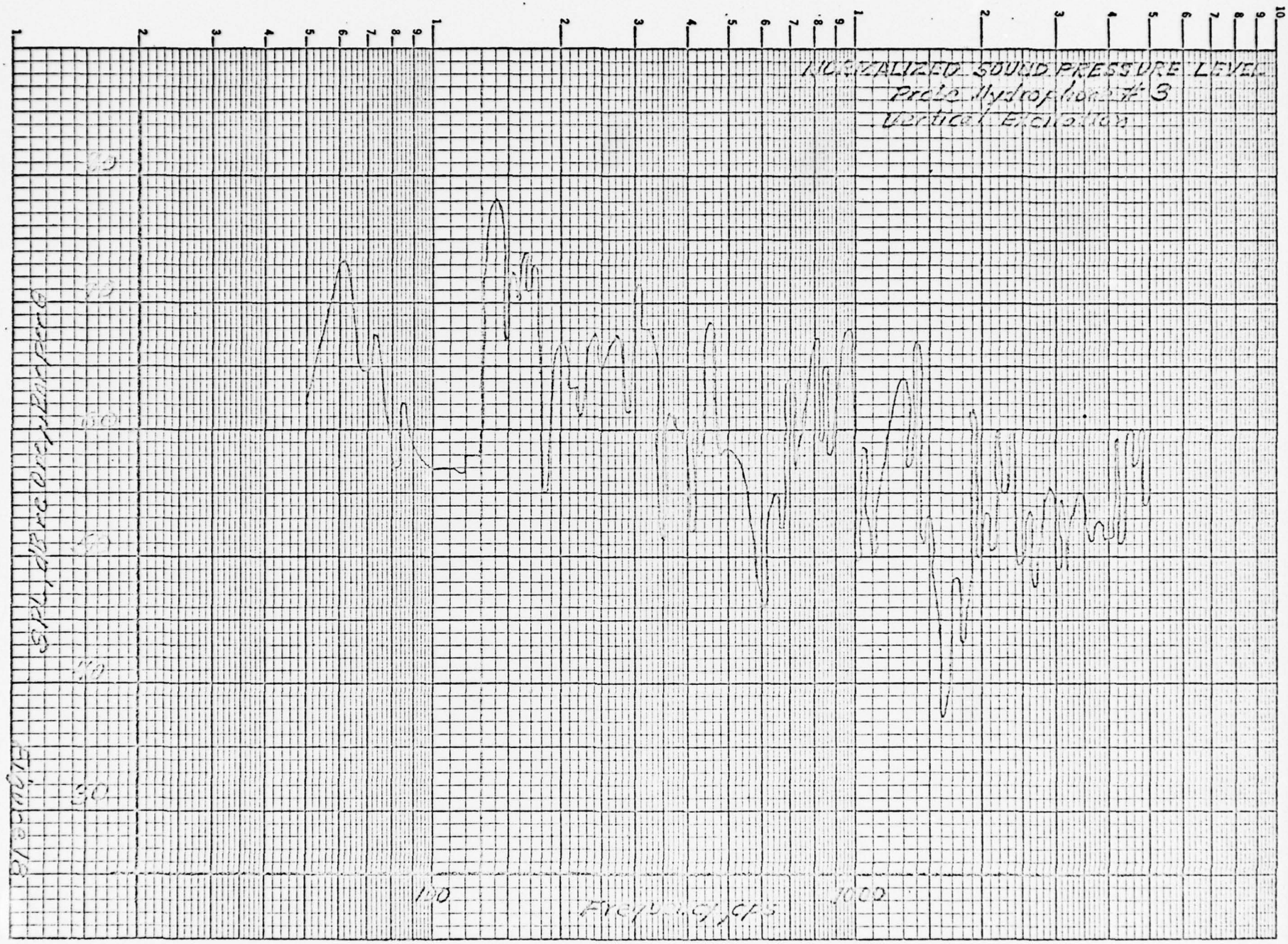
NORMALIZED SOUND PRESSURE LEVEL
Piotr Hydrophone #12
Vertical Elevation
SOUND PRESSURE LEVEL re 1 dyne/cm²
Frequency, c/s
100
1000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NORMALIZED SOUND PRESSURE LEVEL
Probe Hydrophone #3
Vertical Excitation
SPL, db re dynes/cm²
80
70
60
50
40
30
100
FREQUENCY
1000

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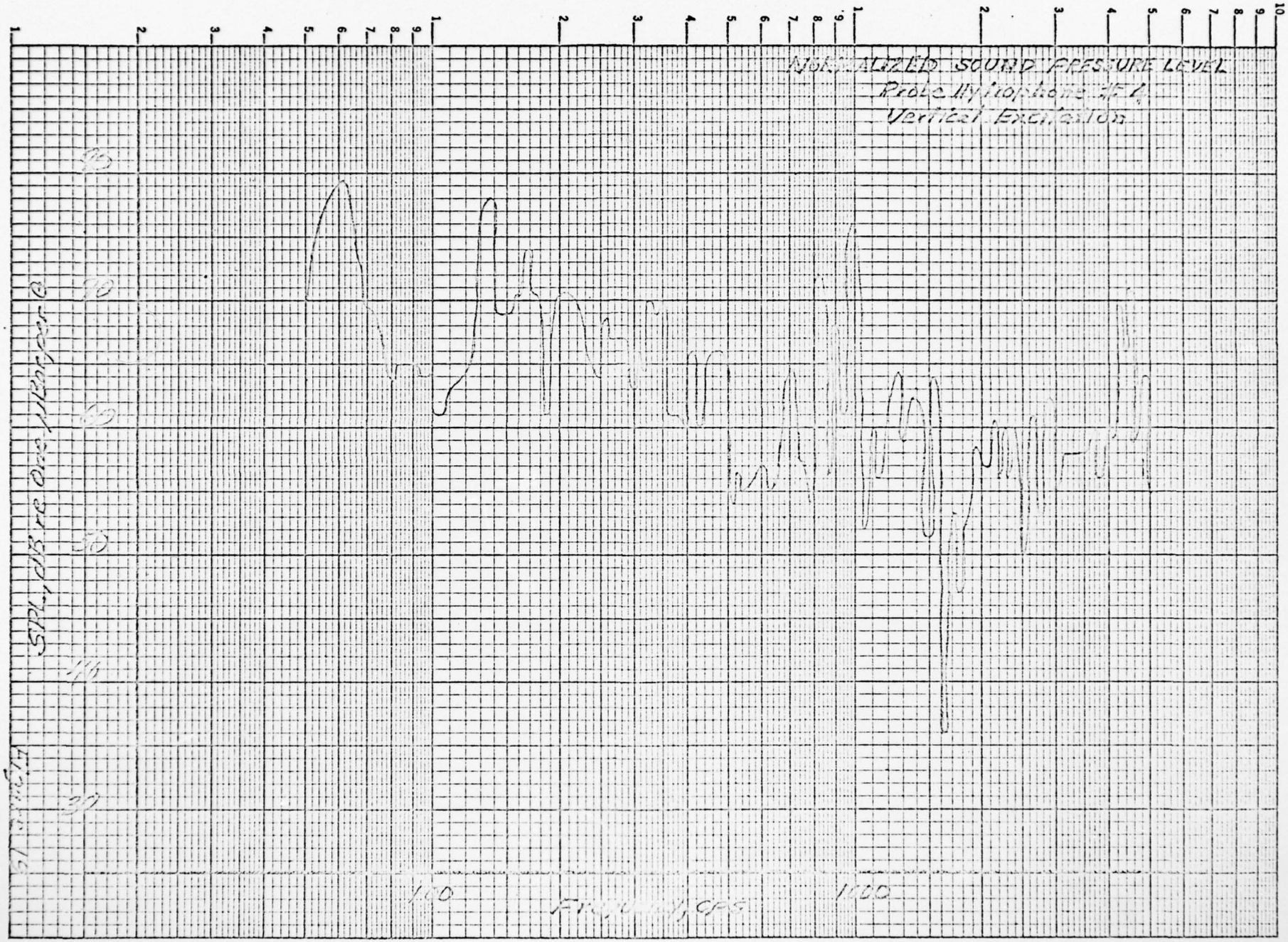

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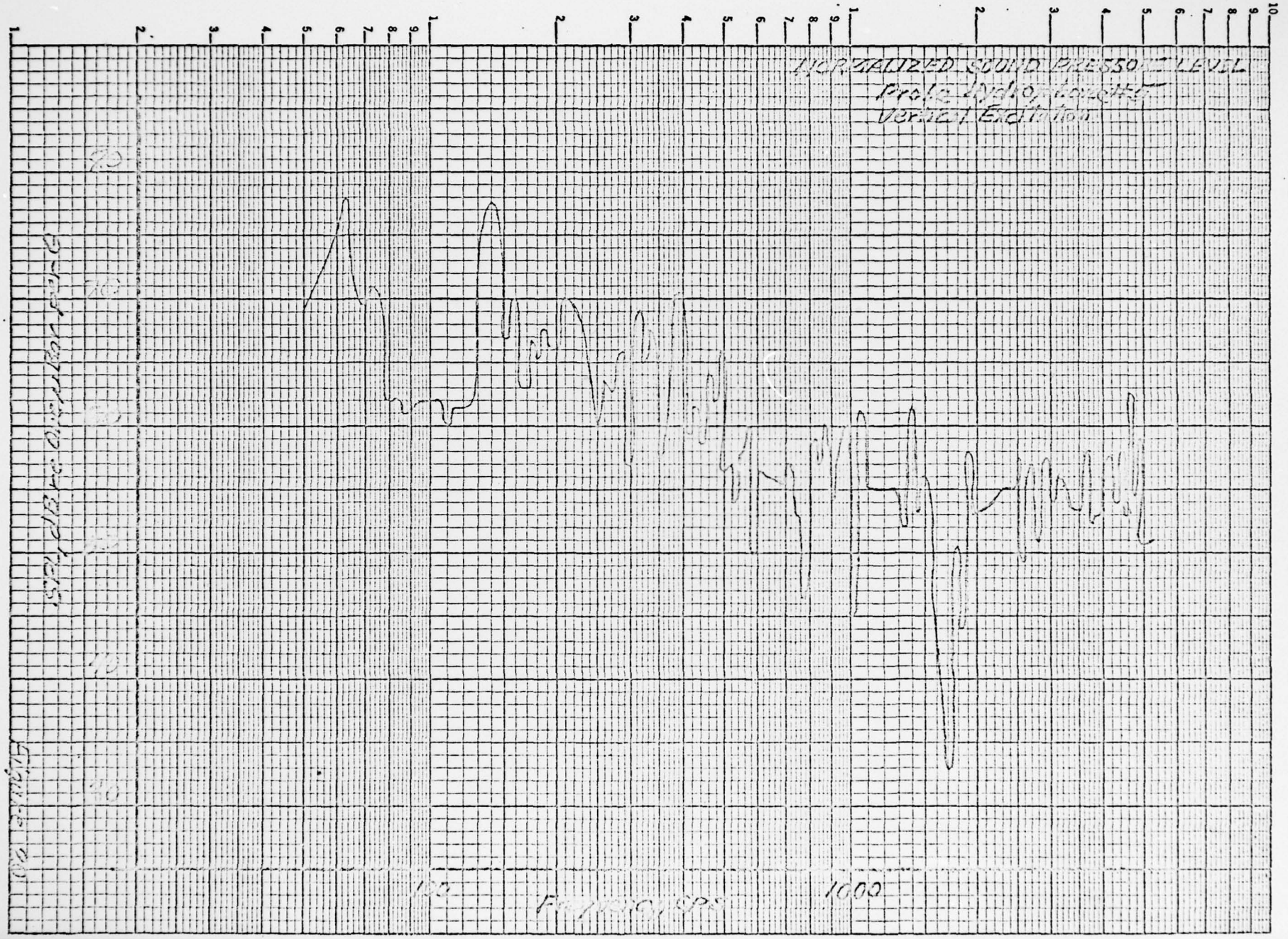

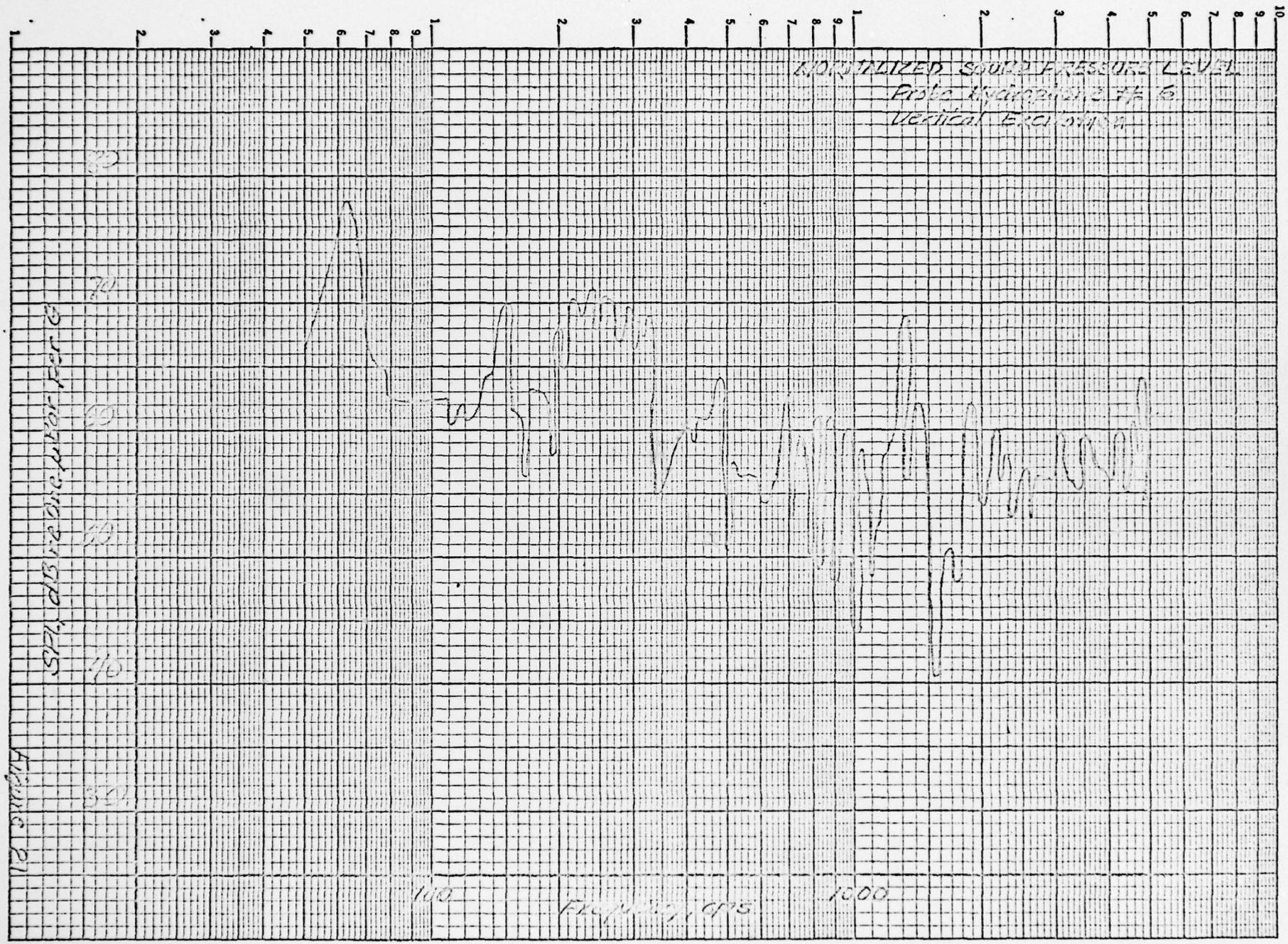
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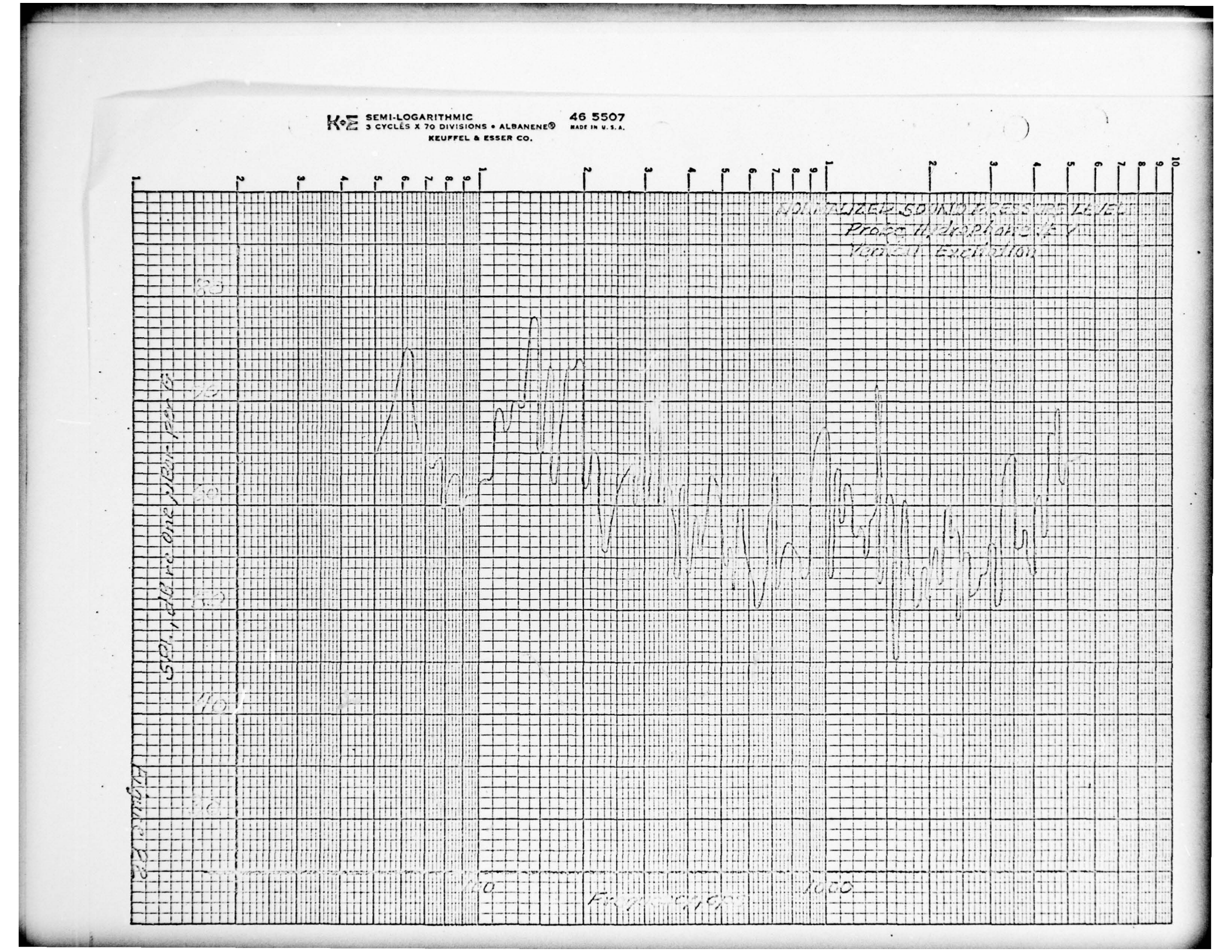
NORMALIZED SOUND PRESSURE LEVEL
Vertical Excursion
SPL, dB re 2 x 10⁻⁵ newtons per sq meter
100
1000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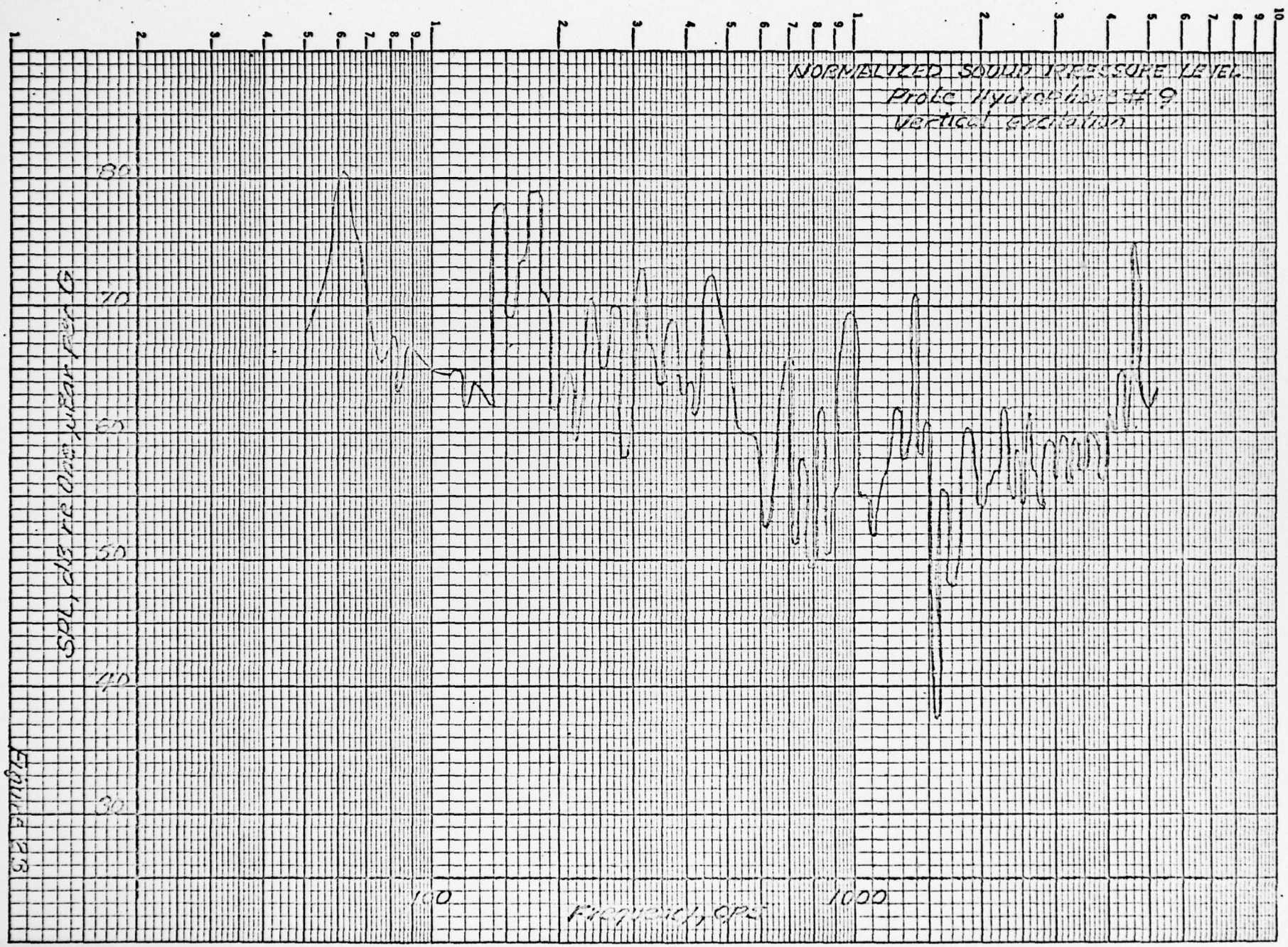
Sound level re one dyne per sq. cm
80
70
60
50
40
100
1000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Probe Hydrophone #9
Vertical excitation
80
70
60
50
40
30
SOUND PRESSURE LEVEL IN DECIBELS
EQUIVALENT
100
1000
FREQUENCY IN CPS

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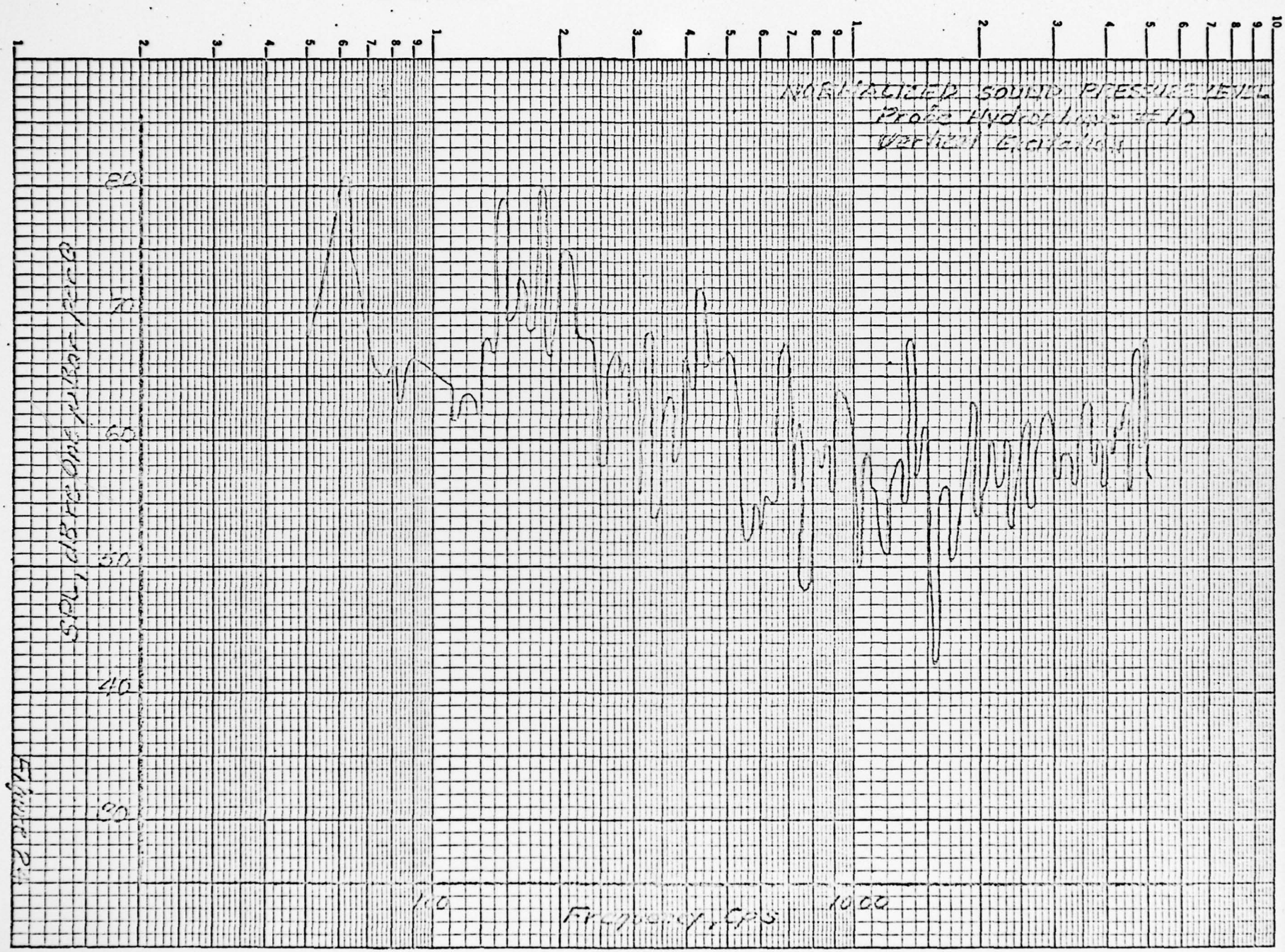

Figure 2

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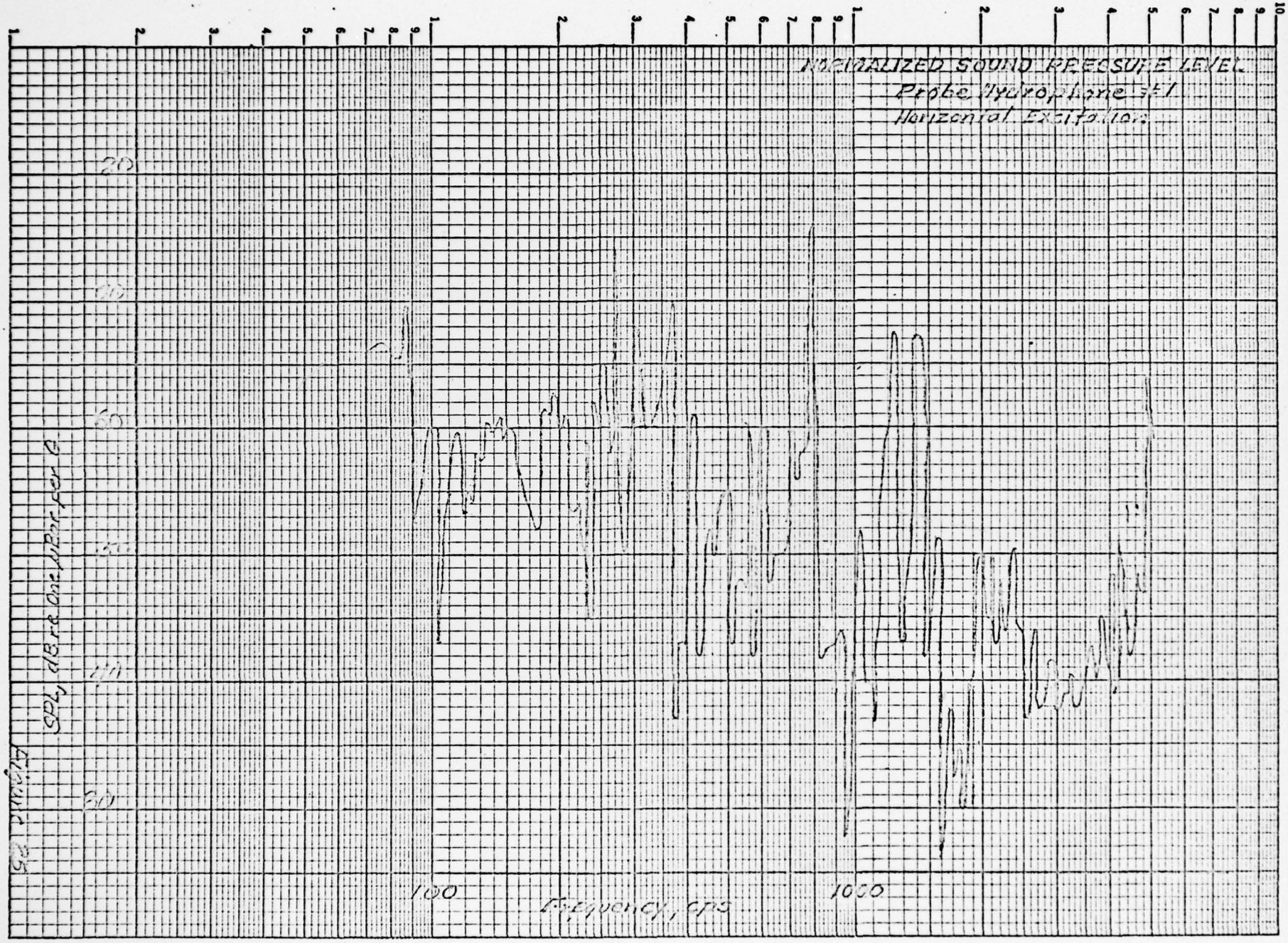

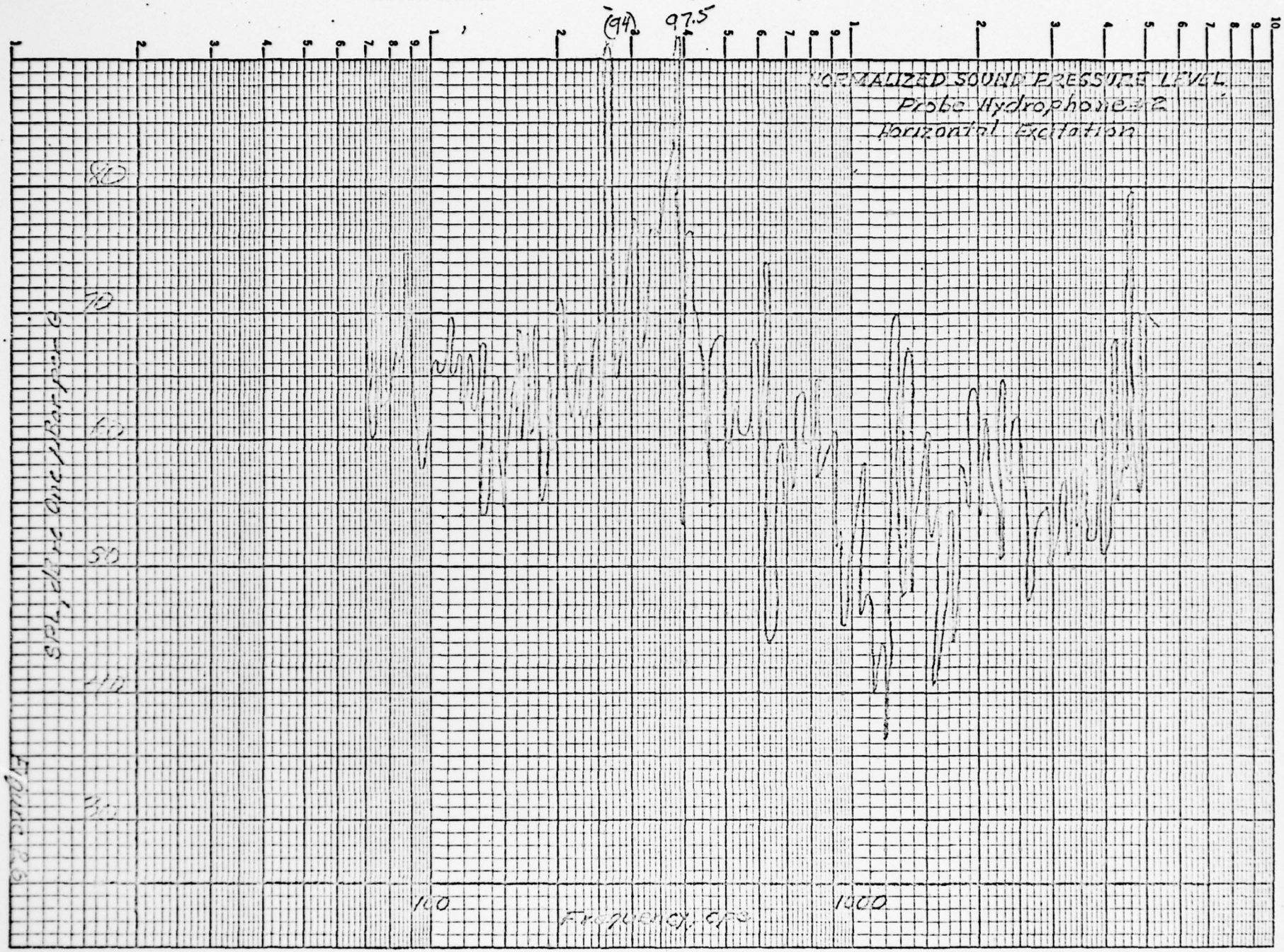
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(94)
97.5
NORMALIZED SOUND PRESSURE LEVEL
Probe Hydrophone #2
Horizontal Excitation
80
70
60
50
40
30
100
FREQUENCY CPS
1000

Figure 28

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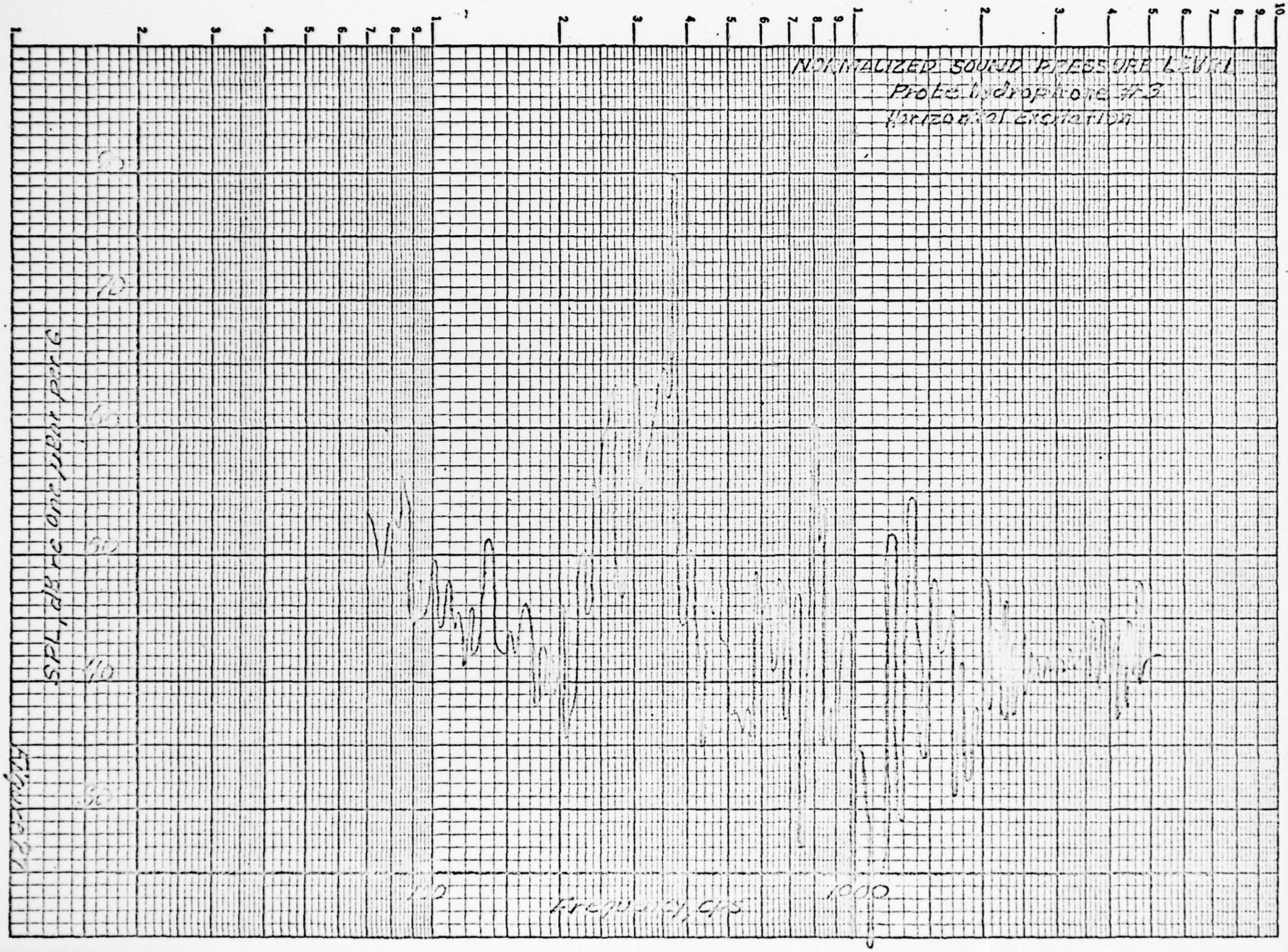

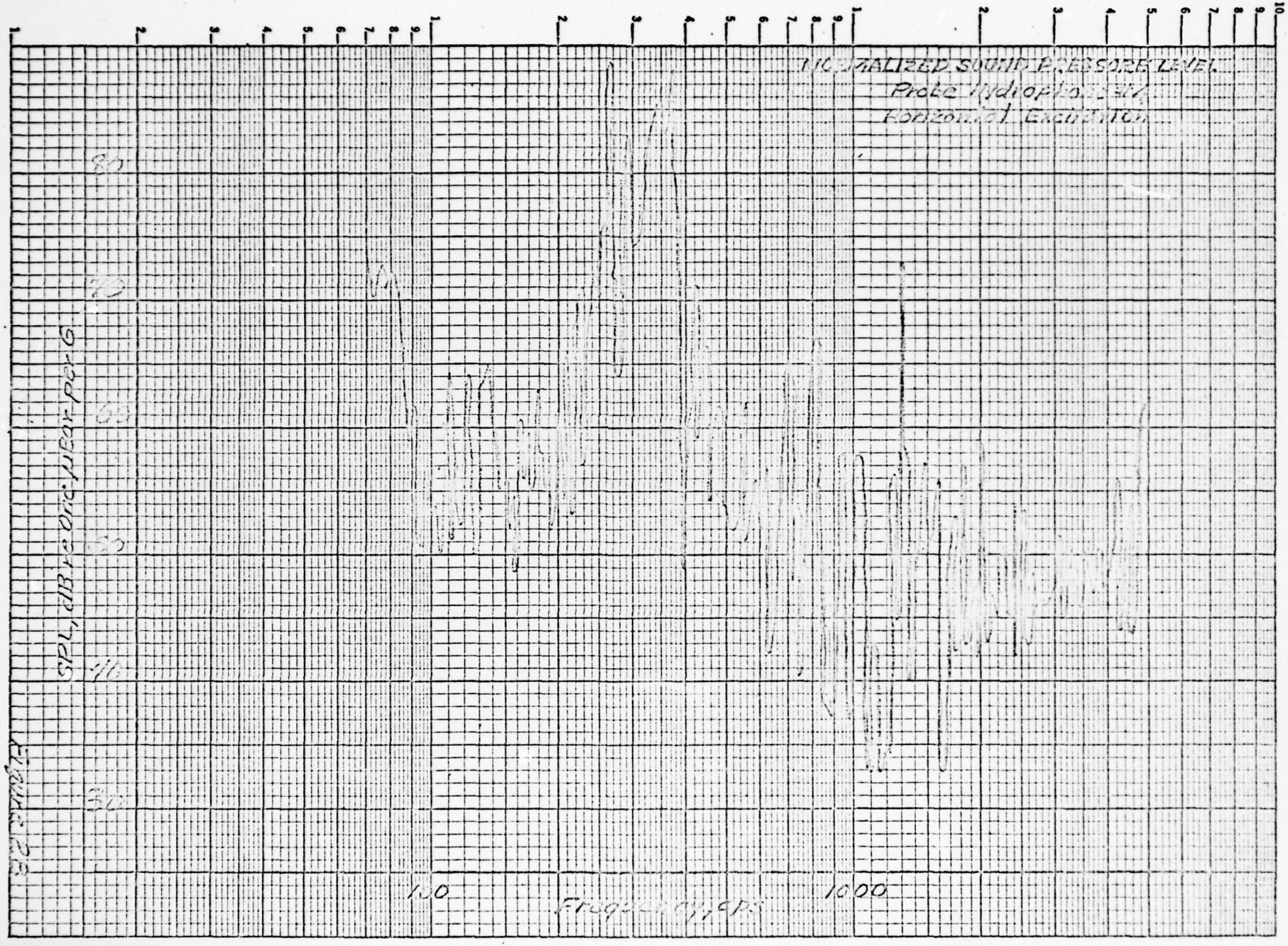
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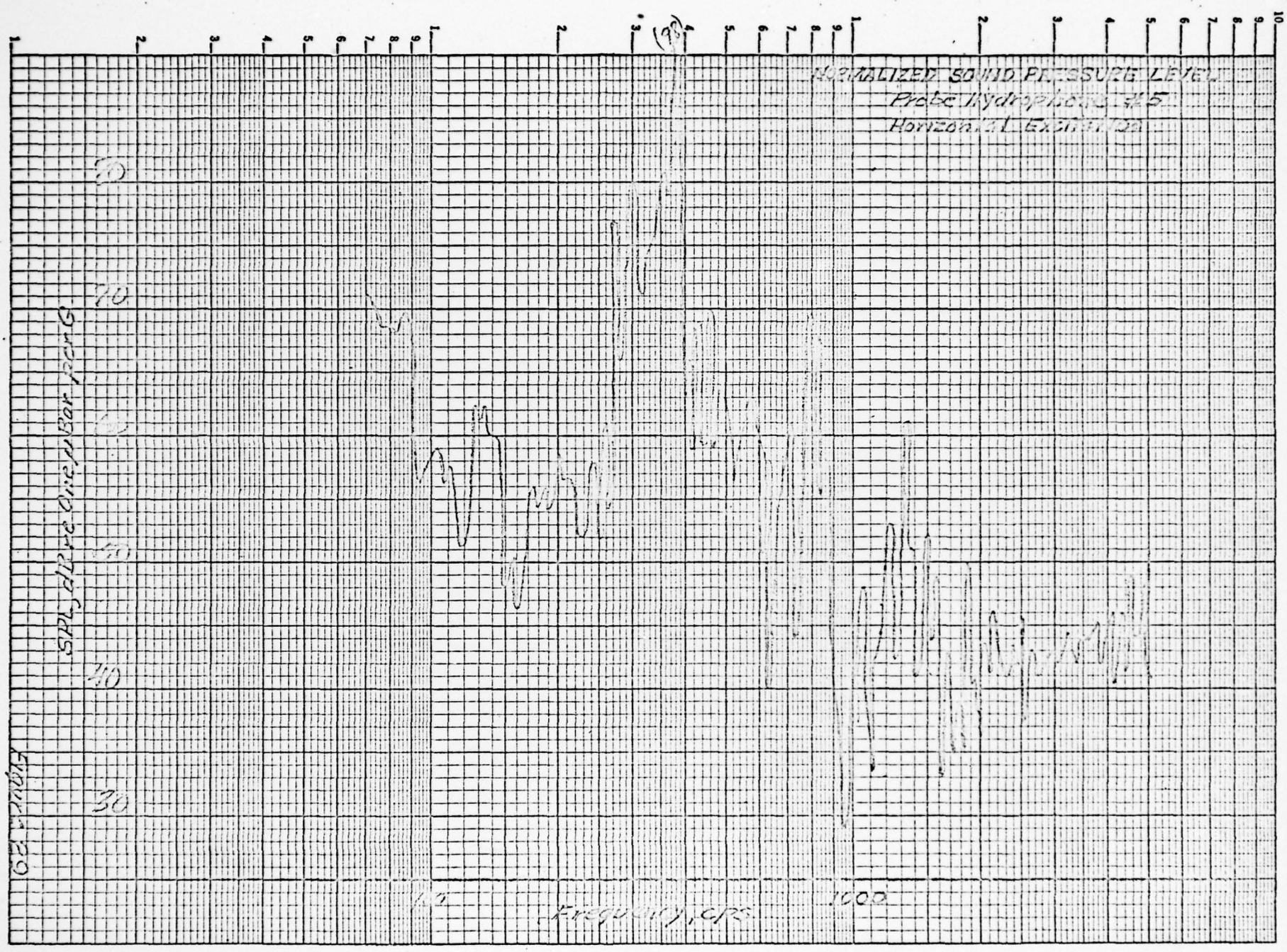
NORMALIZED SOUND PRESSURE LEVEL
Probe Hydrophone
Horizontal Excitation
SPL, dB re 0.1 dyne per cm²
80
70
60
50
40
30
100
Frequency cps
1000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Probe Hydrophone #5
Horizontal Excursion
SPL dB re One Micropar Rms
60
70
80
90
100
Frequency, cps
1000

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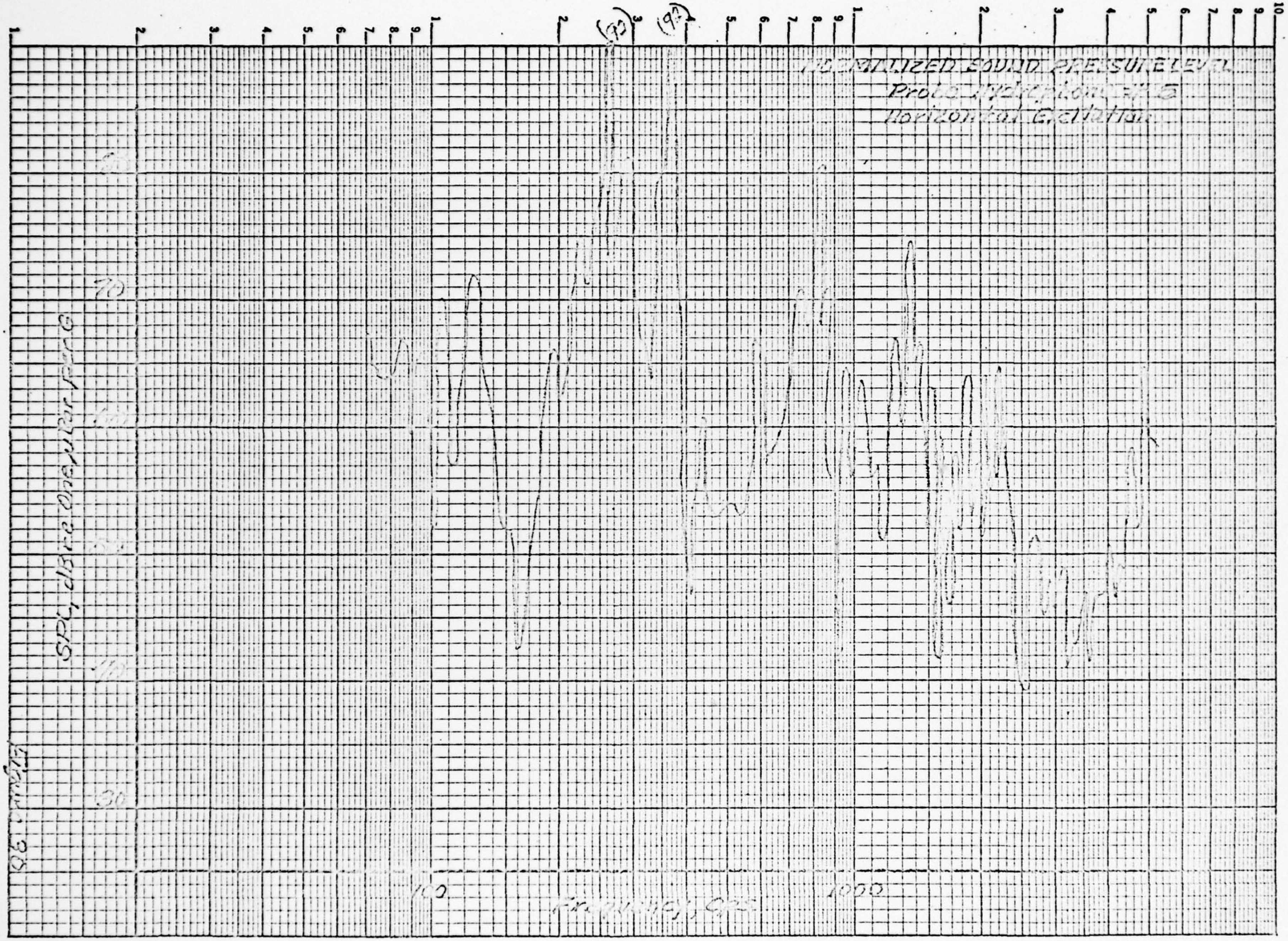

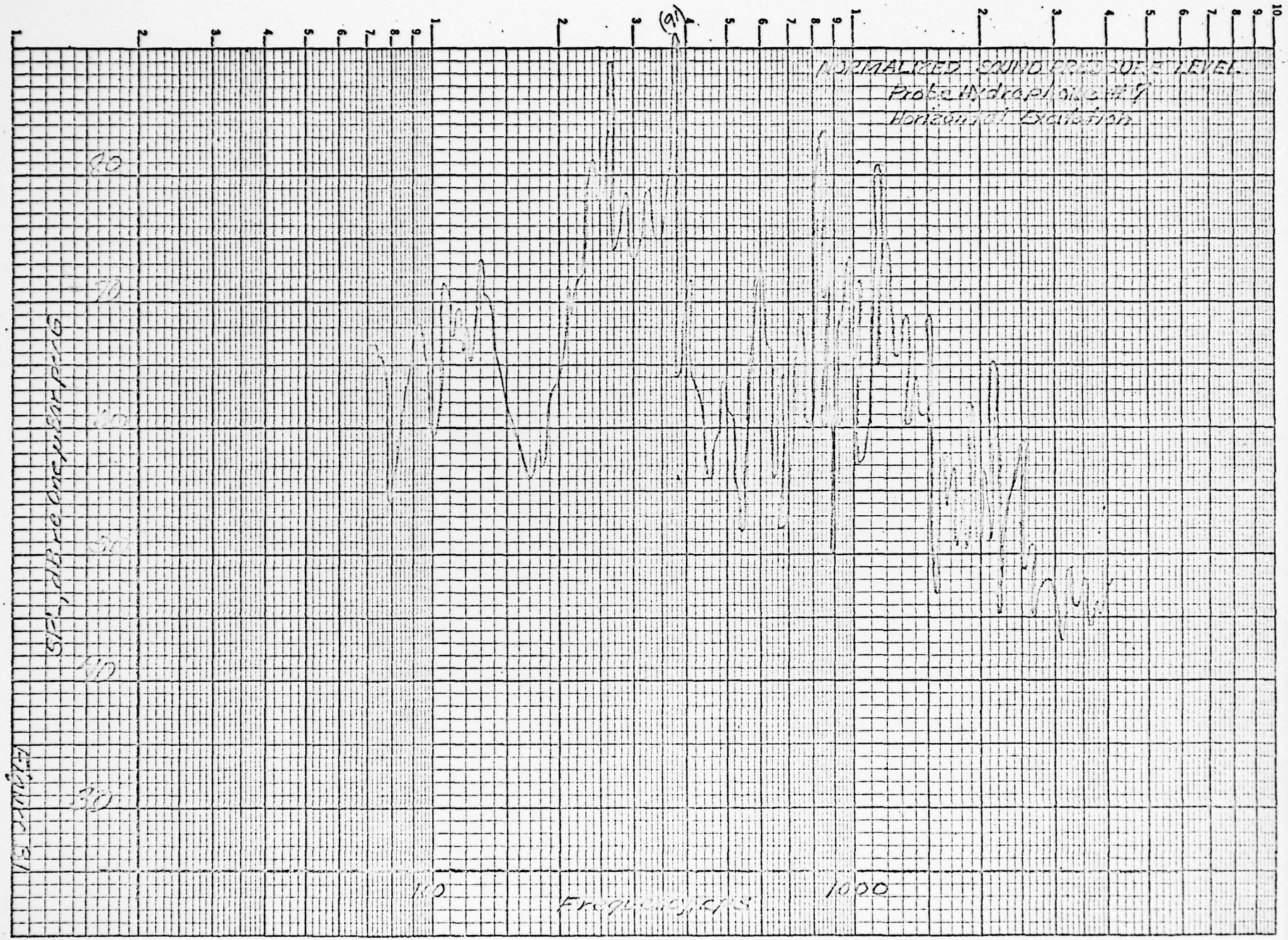
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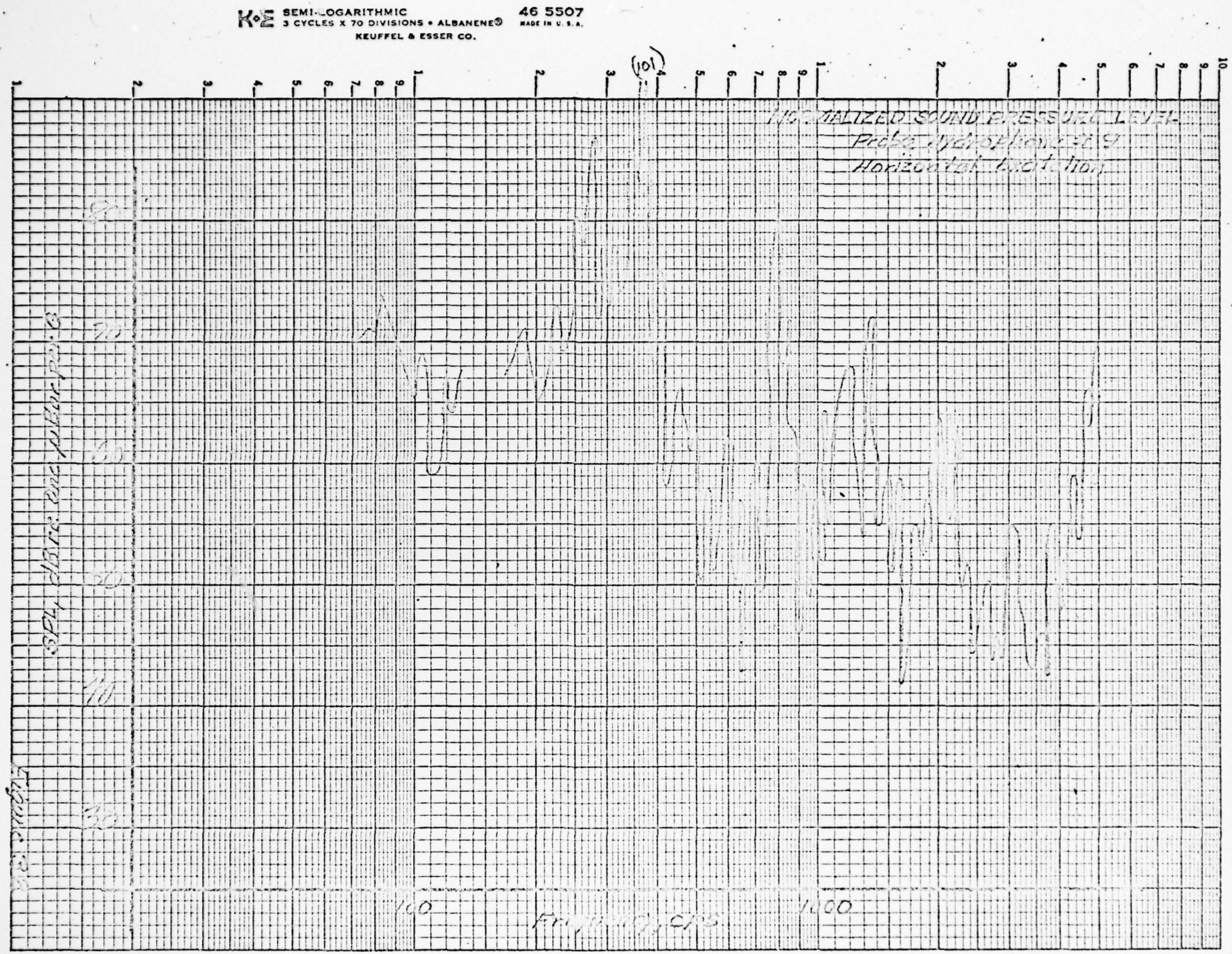
NORMALIZED SOUND PRESSURE LEVEL
Probe Hydrophone #9
Horizontal Excitation
SPL, dB re one microbar
80
70
60
50
40
30
100
Frequency
1000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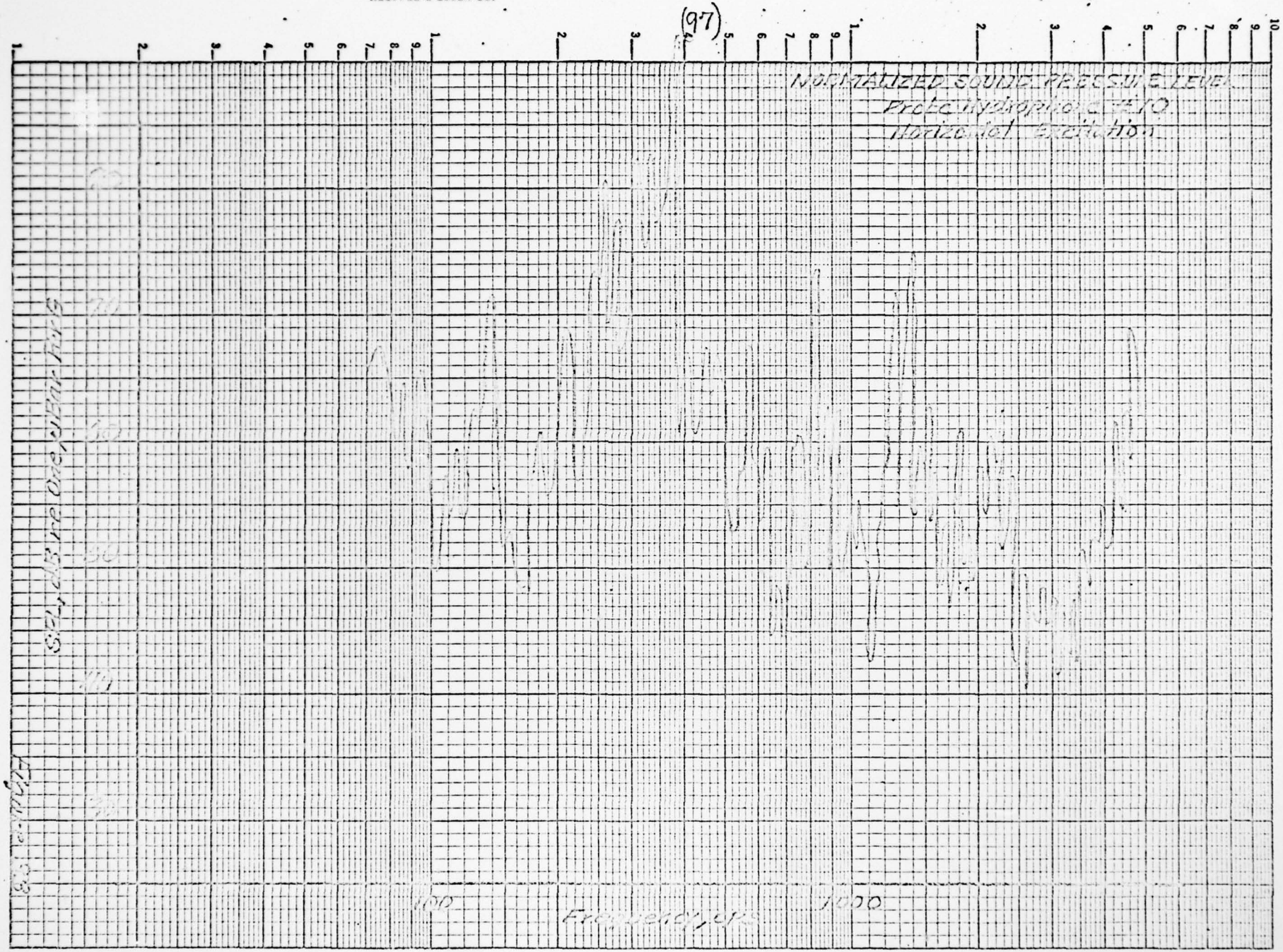
NORMALIZED SOUND PRESSURE LEVEL
Probe Microphone #2
Horizontal Location
Sound Pressure Level, dB re 0.0002 dyne/cm²
100
1,000
Frequency, cps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NORMALIZED SOUND PRESSURE LEVEL
Probe hydrophone #10
Noise del explosion
SEL dB re One Micro Pa²s
Frequency cps
1000